THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW

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SPECIFICATIONS AND CONTRACTS.

WHEN the weekly notes in the leading electrical papers are being perused, it is astonishing to see, in the case of various works where extensions are in progress and a L.C.B. inquiry is held, that so much of the loan applied for has been already spent, but exact details as to how, or on what particular plant, the expenditure has taken place are not forthcoming.

The various loans have been lumped together, the original estimates greatly exceeded and expenditure incurred over and above the amounts sanctioned, and then ignorance as to details is put forward as the excuse, and this covers up the shortcomings of those responsible for the work.

Many are the pitfalls awaiting those whose inexperience, but magnified importance, leads them to issue specifications while having no grasp of the actual work. And should this part be accomplished by the aid of reference to previous and other similar contracts and by "cribbing" from any other likely source of information, there still awaits them the adjudication of the tenders which, in some cases, would tax the brain of a King's Counsel, so cleverly is the offer sometimes worded.

For successful consulting work a thorough knowledge of all the conditions is essential, as well as of the details of the work to be contracted for, and the best man to possess this is the one who is responsible for the running and upkeep of the plant. What is the position of a man requiring some plant, or wanting some work done? Has he merely to copy previous work, or is he striking out on new lines and departing from former practice? A further question arises: has similar work or plant been made before, is there any other standard to go by, or shall the design be something entirely novel, the plant be made to an original specification, all the responsibility of success or failure being borne by the man who strikes out for himself? The latter course very few people but the actual owners of an undertaking are disposed to adopt, and rightly so, as the spending of other people's money involves a heavy public responsibility.

If a standard design is decided upon, the usual plan in preparing estimates is to get preliminary quotations from several of the leading makers, and upon these to base the probable contract price or cost of the whole job, including all auxiliaries. It is the margin between this and the actual figures submitted under closed tender that brings much food for reflection, and many wearying disappointments, to the budding and enthusiastic consultant. Some time has probably elapsed between the original quotation and final tenders; materials may be dearer, work plentiful, and prices higher. Matters of apparently minor importance are drafted into the specification, upon which contractors are careful to amply cover themselves, and generally, if the offer of the original quotation be carefully compared with the exacting

requirements of the after-specification, one cannot wonder at the difference in price.

To most specifications, particularly of public bodies, there is attached a set of general conditions which every experienced contractor very carefully studies, as there are often included in them penalties or liberties at the sole discretion of one authority, which must influence the final cost of any contract. While the prospective customer should see that his interests are properly safe-guarded, he should not overstep the mark and make restrictions which tell against him on the whole.

One or two points might be usefully referred to in this connection. The person issuing the specification sometimes reserves to himself the full power to accept, reject, amend, or otherwise deviate from the contract, and his decision is to be final in *all* matters. Now, whilst it is not to be denied that he knows his own requirements best, and has full knowledge of what is implied, they must be clearly and fully stated, as he cannot expect contractors to be thought-readers, therefore, an independent authority of good repute should be appealed to for the settlement of disputes. Another favourite clause is to the effect that the works shall be guaranteed and maintained for a certain period. The stipulation first referred to, as to alterations in details, is very ambiguous and needs clear definition by the contractor; the second is contrary to L.G.B. stipulations, as it is the utilising of capital for upkeep when the same should be paid for out of revenue. Payment is another bone of contention, and here, again, should the contract be of any size, the practical outcome is that if by the general conditions the money be withheld for a certain period, the contractor must obviously make allowance for the interest on his money so locked up, and his tender is necessarily increased in amount to this extent.

The time allowed for the execution of a contract calls for clear statement in many instances; the specification should state when the work is to be ready for delivery from the contractor, with details given as to the time necessary for erection. Moreover, time should be stated as so many working days. Out-door work is often hindered by the weather, and, unless specially allowed for and put down in writing, this is certain to cause difficulties on both sides. Furthermore, if several works are proceeding at the same time, great hindrance may be incurred, which is unforeseen, and the contractor may find himself involved in "liquidated damages," so that he cannot be too precise in the making up of his tender.

At the same time one cannot wonder at stringent conditions being put forward and insisted upon when attempts are made to wriggle out of subscribing to a fair specification. Tenderers will fill in the usual form of tender with the amount of their offer signed in the usual way, but send also a covering letter setting out many departures and exceptions to the original specification. To obviate this a clause is necessary to the effect that any departure from the specification must be clearly stated on the form of tender. It is a matter of great difficulty to get all the tenderers strictly to adhere to the specifications excepting for the deviations provided for therein. A great deal of extra expenditure will be entailed if tenders are not all based on the same specification. Any firm omitting one portion because of its inexperience may tender for the remainder slightly under other firms; and yet, should the partial tender be accepted, when the omitted part comes to be carried out separately the cost of the whole job may run out to more than that of the firm which included price for a the whole contract.

It therefore appears that the wording of the general conditions of a contract is a matter which requires a good deal more knowledge of the law, and also of human nature, than the average engineer, without extended previous experience, can be expected to have. It is, therefore, a reasonable suggestion that, in the case of work which is to be of considerable magnitude, and which involves a departure from standard practice, it would be money well spent to retain the services of a solicitor who is intimately acquainted with company law and the provisions of legal contracts, in order to ensure that, on the one hand, no stipulations are made which are against the law of the land, and on the other, that no loop-holes are left for any contractors who may be unscrupulous enough to attempt an evasion of their responsibilities, as expressed in their signed contract.

Immunity from Fire-Risks.

We are glad to learn that the Manchester Electrical Exhibition authorities have taken every possible precaution against any outbreak of fire, and have also adopted the best means of speedily overcoming it if, in spite of all that human ingenuity can devise, such a contingency should arise.

We understand that eight hydrants are available with an ample supply of water and plenty of hose, over 60 sand buckets are distributed throughout the building, and some hundreds of fire extinguishers are charged and ready. There is also a fire engine in attendance close to the building, with steam always up and several firemen at hand night and day.

The building was passed by the Corporation and fire office experts, and all the drapery has been fireproofed.

An impression seems to have prevailed in certain quarters that the article which appeared on page 575 of our issue of October 9th on "Fire Risks" was inimical to the interests of the Exhibition; to us it seems to have had the effect of making assurance doubly sure, judging from the increased attendance. On Saturday last, for instance, several thousands more people visited the display than on the same day of the previous week.

Furthermore, those gentlemen who were practically responsible for safeguarding the Exhibition from the fire-risk point of view, have personally thanked us for an article which they considered not only well timed, but calculated to keep everybody concerned up to the highest pitch of efficiency during the run of the show. Moreover, it has exercised the minds of the editors of the local press to the extent that the Manchester papers are publishing special notices to allay any feeling of anxiety that may have been aroused in the matter. This is as it should be!

The Port of London Bill.

The report of the Joint Select Committee of the House of Lords and the House of Commons regarding the Port of London Bill reveals the complexity of the methods, interests, and conditions that govern and determine the growth of the shipping trade of the Metropolis and the conservation of the tidal-water area of the Thames; but beyond establishing that complexity and bringing together a vast amount of uncoordinated detail, the report is of little assistance in deciding the question as to whether it is wise or foolish to purchase the docks. As is well known, the Bill proposes to establish a new Port Authority, to transfer to that Authority the powers of the Thames Conservancy and of the Watermen's Company, and to acquire the existing docks by creating stock secured upon and paid for by the revenue of the Port. In addition, therefore, to the expense of carrying out engineering works in the docks and channels, revenue would have to be found for the payment of interest on the purchase money, with the immediate result that charges on ships and upon goods entering or leaving the port would be proportionately increased. The cost, therefore, would fall very heavily upon manufacturers. The whole crux of the matter is thus as to whether the principle of purchase is

right or wrong. Nevertheless, the Committee refused to discuss this principle. As a matter of procedure, this elimination may have been quite in order; but from the point of view of those who are concerned with the work implied by the change, and with supplying the money for the proposed experiment, a report that fails to establish the principle of purchase must be held to fail altogether. The public, therefore, will remain dissatisfied and unconvinced. The adroit manner in which the dock companies have been approached on the question of purchase has generally been praised; but the method of arriving at a provisional agreement may be ingenious, even when the provisional agreement itself is undesirable. These agreements with the dock companies are, of course, ineffective unless the Bill is passed into law; and it is significant that recently a conference of representatives of industrial, trading, and carrying associations has unanimously denounced the Bill. The truth is that, while those who will have to pay for the purchase reject the principle of purchase, those who favour the purchase find it impossible to prove the equity or prudence of the principle. Taking into account the proposed purchase price, and the increased scale of dock dues and shipping charges contemplated by the bargain, it is certain that the Bill, if passed in its present form, will hamper and reduce the trade of the port, and that it will result in calamity for London; for the Bill implies increase in the tonnage dues on all vessels entering or leaving the port, increase in the dues on all goods brought into the port, increase in dock charges on all vessels entering the docks, increase in dock charges on all goods entering London by way of the docks, and a new registration fee on all barges and other river craft. It must, therefore, drive shipping from the port, and increase the number of the unemployed.

Electrolytic Iron.

If one-half of Mr. Sherard Cowper-Coles's paper on the production of finished iron sheets and tubes in one operation, which he presented at the recent meeting of the Iron and Steel Institute, be true, and we see no reason to doubt its truth, the world has seen the birth of a new process in electro-metallurgy which bids fair to occupy an important place in the future. We ought, perhaps, hardly to call the process new, for it is but a development along the same lines of the same metallurgist's process of centrifugal depositing of copper, and we may fairly conclude that it was arrived at in the course of the same series of experiments. Iron sheets and thin tubes are specifically mentioned, no doubt because these articles are most easily obtained, whereas when rolled in the ordinary way, they require a maximum of power and labour, and are then, in the case of tin plates at least, only obtained by duplication or redoubling of the plates in the mill. Thus the new process material more particularly competes with such material rather than with thicker stuff. Rotating mandrels are employed as electrodes, as in the centrifugal copper-depositing process, though movement does not appear to be essential, as it is stated that the electrode may be stationary or may be rotated.

It appears that enormous volumes of hydrogen are occluded in the material as deposited, but this can all be driven off by annealing. The hydrogen renders the iron extremely hard, so that it will scratch glass. Sheets of it enclosed with ordinary oxidised rolled sheets in a tight annealing box give off their hydrogen, which reduces the oxide scale on the other sheets, and the whole come out clean.

Curiously enough, if the iron used as the raw material contains uncombined carbon, the deposited iron will be carbon free; but if the iron contains combined carbon, the result will be that steel is deposited. Similarly, an alloy of iron and nickel can be deposited. A notable fact is that this finished iron sheet or tube can be produced at a cost of ½d. per lb., so that the process is already commercial.

It is found that the voltage between the terminals of the depositing cell must be low, but the current density per square foot must be high, something like 100 amperes. The raw material is crude iron or finely-divided iron ore. This is placed in a tank of acid solution.

The crude iron or iron ore is connected to the positive pole of a dynamo, and the iron goes into solution and is deposited. The ore may be "blue billy," lake or bog ore, or other carbonate ore which is thus directly reduced. The electrolyte is a 20 per cent. solution of sulphocresylic iron saturated acid. This acid is made up of 108 parts of cresol and 98 of sulphuric acid, and it is found sometimes to be advantageous to add to the solution a small quantity of carbon bisulphide. The solution is kept charged with iron oxide, and its temperature is kept at about 70° C. The oxide is constantly stirred by moving the electrodes, or by means of a pump, and its specific gravity is about 1·32 when the oxide is in suspension.

The cost of a plant to produce 5,000 tons of tubes, sheets and wire per annum, including a stock of iron under treatment, is estimated at £108,295, and the cost per ton of the finished product is £5 5s. 3d., or 0·56d. per pound. The energy per ton is set down at 50s., but if energy could be obtained for 0·10d. per unit, as it can be now in Sweden, the cost per ton would only be £1 for electrical energy. From this we may calculate the energy per ton to be 2,400 units, but there is no figure given directly in the paper. This is quite a remarkable paper, and points to the possibilities of iron manufacture in water-power countries. It also shows what might be done were our wasted fuel resources, such as blast-furnace gas, converted into power. Every iron works could manufacture some finished iron from its ordinary raw material.

An Electrical Financial Bank in Germany.

It was mentioned in this journal a few months ago that a scheme was in course of promotion in Berlin for the purpose of establishing a bank to finance various kinds of electrical undertakings, the total share and loan capital being estimated at £3,500,000. At the time the project was not viewed with favour in certain banking circles, on the grounds that the existing institutions were sufficient to deal with the question, and that there was therefore no need for the constitution of a new enterprise. Opinions have, however, undergone a change since then, and there is a prospect of the proposal receiving practical effect in the course of the next twelve months. The idea originated with the Allgemeine Electricity Co., which endeavoured to enlist the co-operation of the Siemens-Schuckert Works Co., but the latter at first adopted an attitude of reserve which was almost equivalent to a refusal. The company has, however, now consented to assist, and institutions of such high standing as the Deutsche Bank, the Berlin Handels Gesellschaft, and the Disconto Gesellschaft, will participate in the foundation of the undertaking. The objects of the bank, among others, will be the financing of high-speed electric railways and central power stations, by the issue of shares and bonds which will be capable of circulation, and the financing of orders which may be placed by Government departments and local authorities. It will thus be possible, by the issue of shares and the sale of bonds, to devote the proceeds to payment for work carried out by the two manufacturing companies in question, which will, consequently, not be compelled to make so frequent issues of shares and bonds on their own account as in recent years. This circumstance will afford a greater scope for the activity of the two firms and give them more freedom in the execution of orders. The magnitude of the undertaking is shown by the fact that the share capital as now proposed amounts to £1,500,000, whilst the issue of bonds is to reach £4,500,000, making a total of £6,000,000. The names of certain other manufacturing firms are also being associated with the scheme, but it does not appear that any foundation exists for the reports published in this direction down to the present time. In any case it is advisable to wait future developments before expressing any opinion on the scheme which may or may not be the means of the carrying out of large enterprises. It is, however, strange that the conversion of State railways—the Berlin City railways for instance—should be associated with the project, as the State should be in a position to liquidate any debts that may be incurred on the conversion of railways to electric traction, and not be dependent upon private enterprise to finance Government works.

D

ELECTRICITY APPLIED TO A TYNESIDE DRY DOCK.

The rapid advance of electrical appliances upon Tyneside has placed that portion of the kingdom in the position of a standing example to manufacturing centres, not only in England, but all over the world, and a recent instance of development is to be found in the construction of a new dry dock, electrically equipped, for the Mercantile Dry Dock Co., Ltd., of Jarrow-on-Tyne. The growing volume of business of this firm has necessitated the building of a third

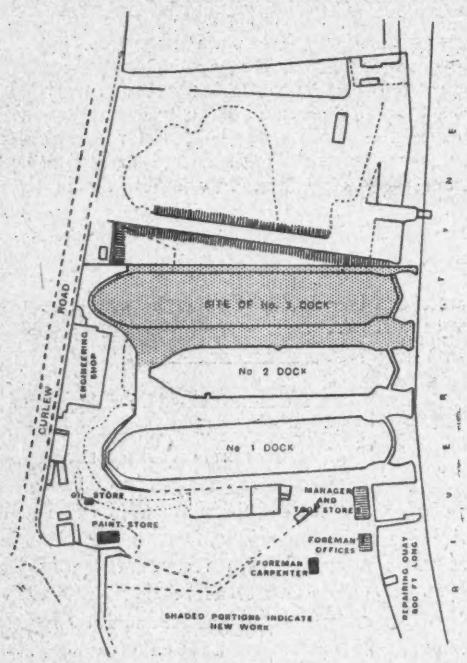


Fig. 1.—Plan of Works.

dock of dimensions sufficient to accommodate the vessels of large tonnage which now enter the Tyne; the dock, which is constructed of concrete, with granite sills and quoins, has been built from the designs and under the supervision of Mr. H. H. Wake, the well-known civil engineer, of Sunderland, in conjunction with Mr. Thomas Hanning, of Newcastle-upon-Tyne.

The accompanying plan gives an idea of the work which had to be done in connection with the scheme, the site of the new dock being shown shaded on the plan. A considerable amount of ground originally used by the firm for auxiliary shops, and a ballast hill 30 ft. above cope level, were included in the area required for the dock. The work necessitated the removal of these buildings, and a great quantity of material.

The contract for the construction of the dock was given to Messrs. Edmund Nuttall & Co., of Trafford Park, Manchester, and the work involved the excavation of about 140,000 tons of material. In carrying out the work, Messrs. Nuttall made use of an electric cable-way transporter, which gave very satisfactory results. The material excavated from the dock was lifted from 50 to 80 ft. vertically, conveyed beyond the bow end of the dock, and dumped into wagons by means of the cable-way, and taken to a deposit about ¾ mile distant by a locomotive. In addition to this, the gear handled several thousand tons of concrete, stone, timber and other materials used in the dock construction. The cable-way was capable of hoisting and travelling the load in every direction and depositing it at any point underneath the line of the cable. The supports or towers were arranged to travel on rails on a trackway laid square to the centre line of the dock, thus allowing the cable-way to be moved across and cover the whole area of the dock. The total span of the cable-way was about 560 ft. The head mast was erected partially on the piling of the coffer dam and partly on special piling for the purpose driven within the coffer dam, and was loaded with a cantilage of about 200 tons. The height of the head mast was about 85 ft., and fig. 4 is an illustration of the gear as erected. The head mast of the tower was constructed of timber, and consisted of four main upright scantlings converging towards the higher end and securely braced on all four sides. The tail mast shown in the second illustration, fig. 2, consisted of two main upright timber scantlings of rectangular section converging towards the higher end, bolted together and having distance pieces and internal diagonal braces. The main cable was 7 in. in circumference, made up of 6 strands, each containing 19 wires. The steel of the cable was of the best quality adapted for the purpose, and was built with a hemp core. Steel ropes were also used for the button rope, the travel rope, and the lifting rope, the load carriage having three cast-steel wheels running on the main cable, and so fixed as to allow the wheels to adjust themselves to the varying curves of the cable. The carriage carried beneath it the load wheel over which passed the lifting rope. It was moved backwards and forwards along the main cable by means of a travelling rope passing from the load carriage to the tail mast, and thence over a 4-ft. wheel to the head mast. From the pulley on the summit of the head mast it was led by suitable guide pulleys to the traversing drum of the electrically-driven winding engine, situated at one side of the dock. The travelling rope made three turns round the drum and returned to the other end of the load carriage after passing round a second wheel at the top of the head mast. As the load carriage moved away from the head mast some provision was, of course, necessary to prevent the slack of the lifting rope from dropping on to the ground. This was provided for by suitable hangers, five in number, which suspended the lifting rope from the main cable. These were automatically dropped at regular intervals as the load carriage travelled towards the tail mast by means of buttons secured to the button rope, and were again picked up by a horn on the load carriage each time this returned towards the head mast.

The winding engine had two drums, each 5 ft. in diameter, one for the endless travelling rope and the other for the lifting rope. Either or both of these drums could be

Fig. 2.—Tail Mast.

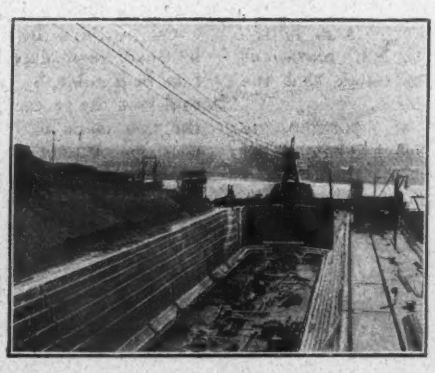


Fig. 3.—Front End of Dock.

Fig. 4.—Head Mast.

thrown in or out of gear by friction clutches, and powerful band brakes were provided for each drum, actuated by foot levers. The cableway was capable of dealing safely with loads of 5 tons, the lifting speed of the cableway being about 220 ft. per minute and the traversing speed about 900 ft. per minute. The winding engine was driven by a 100-H.P. three-phase motor, fed at 440 volts and running at a speed of 480 R.P.M., the current being supplied by the County of Durham Electrical Power Distribution Co., Ltd. The cableway and winding engine complete were supplied by Messrs. John Henderson and Co., of Aberdeen, for the construction of the dock, and constitute a very interesting application of electric drive. Messrs. Edmund Nuttall & Co. utilised electric power for driving all their pumping plant, sawmills, &c., and also for lighting purposes during the short winter days throughout the whole of the construction of the dock.

The third illustration shows a general view of the front end of the dock as the contractors' work was nearing completion. It will be noticed in this illustration that massive iron gates are fixed to the front end of the dock, which are now operated exclusively electrically. The windlass for undertaking this work is illustrated in fig. 5, and was supplied by Messrs. Clarke, Chapman & Co., Ltd., of Gateshead. It will be seen that the gear is fitted with four cable lifters, each of these being suitable for $1\frac{1}{16}$th cable, the object being to make the one windlass capable of dealing with the gates of two docks, and for this purpose the windlass is situated at the front end of the dividing wall between No. 2 dock and No. 3 dock. Two lifters are used for each pair of gates, one operating the closing cable and the other the opening cable. An ingenious arrangement of cable has been fitted for this purpose, the closing cable being attached to the side of the dock wall, and passed through snatch blocks on each gate. Tension on the rope brings these two points together, and closes the gates by means of a pull on the single cable. The opening action is accomplished by means of a chain attached to each gate, passing over guide pulleys and joined together on to the main cable. The windlass is designed to exert a pull of 6 tons at 40 ft. per minute on either of the lifters operated separately, but not more than one at a time. Each lifter is provided with a friction clutch and brake so that while one pair of gates is being operated, the chains of the other are secured by means of the brakes on the other pair of lifters, and while the closing cable is being hauled, the opening cable is allowed to run freely, its lifter having been uncoupled from the shaft. As will be readily seen from the illustration, the windlass is driven by a combination of spur and worm gearing, the latter running in an oil bath and provided with a special roller thrust on the worm shaft. Between the motor and the worm is fitted a friction clutch, the disks of which are enclosed in cast-iron boxes and immersed in oil. The pressure on these disks is so adjusted that the clutch slips with an overload of about 50 per cent., the object being to prevent the imposition of a severe shock on the motor in the event of the gates being jammed by anything getting between them or current not being promptly cut off when they come together. To the outside of this coupling and to the half connected with the worm shaft is fitted an electrically operated brake, so that as soon as the current is cut off from the motor the brake is applied, thus preventing any possibility of the cables easing back.

The windlass motor is of the three-phase type, wound for 30 H.P. intermittent duty, and runs at a speed of 770 revolutions per minute. A tramway type controller is adopted for operating the motor, and this, together with the motor, was supplied by the B.T.-H. Co., of Rugby. It will be noticed from the figure that a hand gear is also fitted to the windlass shaft, so that in the event of the current supply being cut off it can be worked by means of a couple of handles, not shown in the photograph, fixed in the cross beam shown above the worm gear. This on being worked backwards and forwards operates the windlass shaft by means of the pawl gear shown on the main spur wheel.

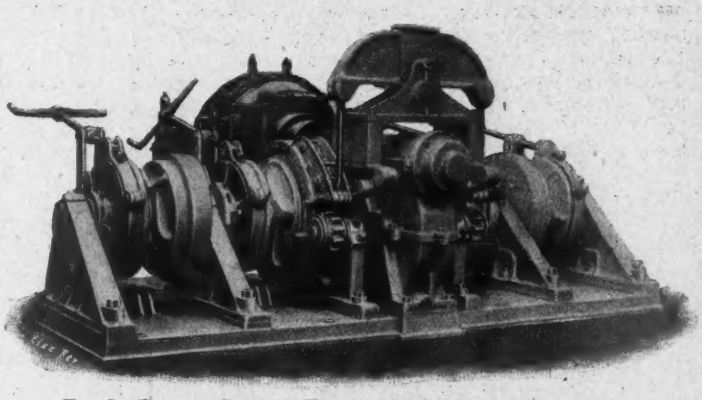


FIG. 5.—CLARKE, CHAPMAN ELECTRIC WINDLASS FOR DOCK GATES.

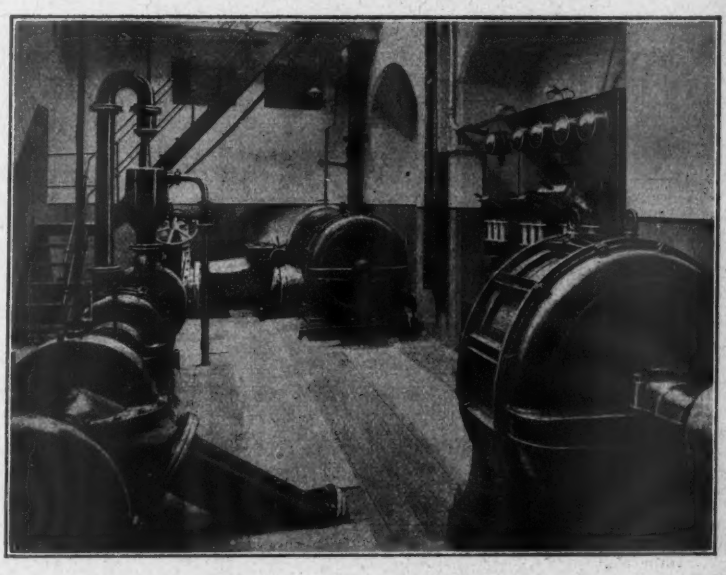


FIG. 6.—B.T.-H. MOTORS AND GWYNNE PUMPS.

When the gates are closed the dock is emptied by means of a pumping plant supplied by Messrs. Gwynnes, Ltd., consisting of two main pumps of their "Invincible" G type, electrically driven. The two sets of pumps and motors are together capable of delivering 3,500,000 gallons of water from the dock in two hours; pumping is commenced with 23 ft. of water over the dock floor, the outside water level being 25 ft. 9 in. above the dock floor. The cases of the pumps are made with large covers, so that the disks can be removed and replaced without disturbing a single joint either in the suction or delivery mains. The disks are of the shrouded type, and the pump branches are of 25 in. internal diameter. To provide for direct electric drive, each pump has an extended bedplate, the armature spindle and pump shaft being connected with flexible couplings of the Voith pattern. Each delivery branch of the pump is fitted with a retaining valve, having balanced weights to relieve the pumps of the pressure of holding up the valve when working. Moreover, a sluice valve is bolted to the outside of the retaining valve. The motors for driving these pumps are of the B.T.-H. squirrel-cage type, running at 335 R.P.M., with a frequency of 40. In addition, a set of three centrifugal pumps on one base plate is installed, driven by a single motor, the first pump having 10-in. suction

and delivery branches, to be used for drainage purposes. The second pump works in series with the 10-in. pump, and has 5-in. suction and delivery branches arranged for filling the tanks of vessels, and the third pump has 6-in. suction and delivery branches, to supply the necessary water pressure for the patent charging apparatus for removing air from the main and drainage pumps and suction pipes. A friction clutch with suitable lever is provided between each two pumps, so that either may be thrown out of operation when necessary. The drainage pump is capable of delivering about 2,000 gallons per minute, and the 5-in. pump working

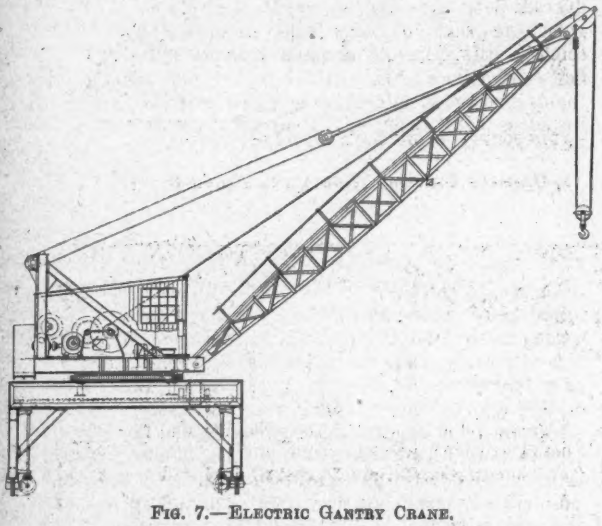


Fig. 7.—Electric Gantry Crane.

in connection with the drainage pump will deliver about 500 gallons per minute 20 ft. above the dock cope level, through 750 ft. of 6-in. piping—the speed of this set being 575 r.p.m. The drainage pump is provided with a sluice valve, and the delivery branch with a set of suction pipes and foot valve. Messrs. Gwynnes have also provided a standpipe fitted with an indicator in the pump room, to record automatically the height of water in the dock and pump well. The piping in connection with the gearing for showing the water level is carried down to the bottom of the sump. All the electrical motors and gear in the pump room, including cable connections, are of the B.T.-H. Co.'s manufacture.

In order to cope with the work on board any ship in dock, the Mercantile Dry Dock Co. placed an order with Messrs. C. and A. Musker, Ltd., of Liverpool, for a travelling gantry crane, capable of lifting a maximum load of 15 tons at a maximum radius of 53 ft. 2 in. The minimum radius at which the crane will work is 35 ft., and its total lift is 55 ft. As will be seen from the illustration, fig. 7, the crane is mounted on a high truck with a clear head room of 10 ft. This travels upon six tram wheels 2 ft. 6 in. in diameter, at 20-ft. centres, running on wheels laid along the dividing wall between Nos. 2 and 3 docks, and having a gauge of 26 ft. The motions of the crane are worked electrically and consist of hoisting, derricking, travelling and slewing. With regard to the first motion, the gear is of cast-steel spur reduction machine-cut, each end of the hoisting rope being fixed to the barrel, which is grooved right and left-handedly, the ropes passing round the return block and equalising sheave. The hoisting speed when carrying 15 tons is 20 ft. per minute, and is operated by a motor of 30 h.p. running at 575 r.p.m. The derricking is performed by worm and spur machine-cut gear, driving a similar barrel to that on the hoisting gear, the derricking rope being fixed to the barrel and led over movable multiplying sheaves carried by forged steel tie-rods fixed to the jib end. A motor of 25 h.p. running at 575 r.p.m. is employed, the time taken to derrick from a radius of 53 ft. 2 in. to 35 ft. being only 2½ minutes. The slewing gear is driven by means of worm and spur reduction gear, the pinion being keyed on the end of the worm shaft, which engages with a rack bolted on the top of the pedestal, thus revolving the crane. The slewing speed on the hook is 350 ft. per minute, a motor of 8 b.h.p. running at 575 r.p.m. being sufficient to give this. The motion of the crane along the dock wall is produced by bevel and spur reduction gear, driving travelling wheels on the opposite sides of the track. The travelling motor runs at 575 r.p.m. and is of 30 h.p., and this gives a travelling speed with 15 tons load of 10 ft. per minute. Electric and mechanical brakes are provided on the hoisting and derricking motions, and a mechanical brake on the slewing. All the motors are of the multipolar totally enclosed induction type, with slip rings, the controllers being of the tramway type with metallic resistances. The total weight of the crane is 105 tons; the structure, jib and mast are built up of rolled-steel section plates and angles, the crane revolving upon a live ring of steel rollers. All the motors are housed in, the operator standing at the front of the cabin having full control of all motions, and a clear view of the load. An enamelled slate switchboard is placed near the operator, fitted with a double-pole main switch, fuses for each motor and switches for lighting, besides the usual ammeter and voltmeter. The current is conveyed to the crane by means of conduits provided in the causeway, with conductors and insulators, collectors being placed on the leg of the crane.

It will be seen that the above installation furnishes an instructive and up-to-date example of electrical equipment in shipyard work. We are indebted to the courtesy of Mr. M. C. James, the managing director of the Mercantile Dry Dock Co., Ltd., for his permission to give this account of the equipment, and also to the various contractors who have furnished us with particulars of their work.

CORRESPONDENCE.

Letters received by us after 5 p.m. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Auto-Transformers.

With reference to recent correspondence in your columns on the above subject, there is still another side to this question.

I see it reported that, owing to reduced revenue, some supply undertakings are revising their tariff, which may be another good reason for postponing the introduction of auto-transformers, and I for one have decided to play a waiting game.

Cityite.

[Our correspondent's suggestion seems rather to be an argument in favour of introducing auto-transformers; for the price is not likely to be reduced, under the circumstances.—Eds. E.R.]

On Catalogues.

The interesting article headed as above in your issue of October 9th, prompts me to offer a word or two of complaint regarding this kind of literature.

I happen to be one of those individuals who every day receive a fair number of catalogues, pamphlets, leaflets or booklets, and whilst the majority are worth looking at, and a few worth careful reading, it is an unfortunate fact that owing to the varied dimensions a large number of them cannot very well be filed for reference, without making the catalogue shelves most unsightly. I suppose it is too much to expect that all firms should agree upon a definite size for advertising literature, but if it could be done I am sure that many papers that are now tossed away would be kept.

I have tried several methods of keeping catalogues, &c., but unless they are filed according to dimensions, it is difficult to arrange them neatly; but this method has a considerable disadvantage, inasmuch as catalogues should be arranged according to subject matter, and not according to dimensions.

Another point, which is of greater importance, is the question of discounts.

Occasionally lists are sent out with discounts attached, but more frequently this is omitted; and although this information may be obtained for the cost of a penny stamp, and by waiting at least two days, it often happens that a

firm is passed when an urgent order comes in, simply because the purchaser has no definite idea of the real price of the article listed. Day after day I receive well got up sheets or pamphlets, without a word as to discounts, and if manufacturers would only give even an approximate discount for quantities of one or more, it would, I am sure, be greatly to their advantage.

Many manufacturers have, I know, an objection to attaching discounts with price lists—preferring to quote specially—but in innumerable cases where the articles appear to be turned out by the dozen or the gross, there can be little objection to giving this information.

Perhaps some of the firms implicated above will be good enough to send their views on these two points.

W. H. B.

Lot's Road Shut-Down.

Most of your readers will agree with Mr. W. H. Taylor that more light on the cause of the recent shut-down at Chelsea is desirable, but I suppose few would be prepared to admit that they had been enlightened by that gentleman's letter. Your correspondent first seems to imply that the accident was due to an error of judgment in the running of the station, in that the sets were running in parallel, and then appears to conclude with the opinion that the up-to-date arrangements have not tended to obviate a breakdown. What we should like to know is, whether the parallel running, mentioned by Mr. Taylor, is the normal state of affairs, and whether each unit could have been isolated with its own section of the load, so as to have minimised the effects of a shut-down.

We can hardly follow the process of reasoning that leads your correspondent to issue so comforting an assurance to chiefs in charge of small stations, that although antiquated they are at least safe. He surely compares the shut-down with the effect on the "man in the street," for Mr. Taylor would hardly have us believe that any intrinsic safety, or non-liability to shut-down, attaches to the small dimensions of a station. A statement that a small station is immune from a breakdown of so tremendous a magnitude as that of Chelsea is, on the face of it, obvious, and is no cause for congratulation, nor is it an excuse for comparing a small station with a bed of roses.

Student.

October 17th, 1908.

Applications for Situations.

Being one of the applicants for the appointment, advertised by "8,441" in the ELECTRICAL REVIEW, of May 8th, 1908, I feel it my duty to testify in support of "8,441" statements, that on June 4th, 1908, that gentleman met me by appointment, and courteously accorded me an interview, when he gave my application every consideration.

I might say that this communication is entirely spontaneous; further, that I was not the successful candidate for he appointment.

J. Surrage Blackmore.

Birmingham, *October 19th*, 1908.

Metallic-Filament Lamps.

In your last issue, and in many previous issues, I have noticed complaints from various sources concerning the treatment meted out to recipients of broken lamps; whilst in agreement generally with your correspondent "W. M. E." as to the merits of tantalum lamps, I have found it a serious inconvenience having always to use two lamps where one would usually be better; I had therefore to find a lamp which would burn direct on high voltage. After trying many agents for the different types of lamps, I can strongly recommend your dissatisfied correspondents to try the Sloan Electrical Co., who not only replace broken lamps without fuss or bother, but go so far as to replace those which giv an abnormally short life. The above has been my experie n and I thought the information would be of interest to t ese of your readers who have paid for lamps, and received in return glass globes and other things, being afterwards informed by the vendors that the risk must be taken by the purchaser, also being informed by means of a printed circular that they are to sell these lamps (?) at a certain price (the irony of it)!

H. L. Alderton,
Engineer and Manager.

Electricity Works, Guilford.
October 19th, 1908.

Cost of Living in Mexico.

Your readers who are inquiring about the conditions of life in Mexico would, doubtless, obtain reliable information if they wrote to my brother, Mr. G. V. D. Vallancey, at the British Club, Mexico City. I am sure he would be pleased to assist in any way, and his business of shipping agent gives him every opportunity of studying all parts of the country. It might be well to mention this letter.

F. Hugh Vallancey.

London, N., *October 19th*, 1908.

It Proved a Slip.

Mr. W. P. Whitehouse, in his communication in last week's issue, has struck the right note in advocating the use of expansion joints in underground mains laid in districts subject to earth subsidences.

My experience is that in such cables a Bowden wire action is *continually* taking place between the cores and the lead sheathing, and on a fault occurring, owing to the two different metals—lead and copper—one finds that the lead will thin out on the whole length from joint to joint, whilst the cores invariably pull out at the ferrules; often it occurs that one core is pulled at the fault, and in the previous joint others may be partially severed. The lead sleeves in no instance showed any signs of tension, and in many cases the fault occurring at light loads, no trace of the fault appeared on the outside of the joint, the troughing, bitumen and lead sleeve being intact.

Obviously the only way to meet these conditions is to incorporate some form of expansion joint; zig-zagging the cable will not overcome the difficulty explained above in its entirety, but the system of brick trenching at intervals put forward by Mr. Hardie McLean in conjunction with expansion joints would, in my opinion, make up a fairly safe system; this, coupled with the desirable practice of running duplicate mains to important consumers, should eliminate a great percentage of mains troubles.

I am awaiting an opportunity of putting into service an admirable type of expansion box recently brought out by Messrs. Callenders which, whilst allowing for 8 or 9 in. of pull on the cores and retaining the use of plumbing glands, enables one to frequently inspect the movements of the cable and, incidentally, forms a very convenient point for localisation at times of fault, the cores being easily disconnected; of its action in practice I cannot as yet speak, but as its insulation properties are as high as, if not higher than, those of an ordinary joint, and as it is mechanically sound, it should come up to its claims.

The practice of connecting up two tail-end boxes by flexible leads cannot overcome the above difficulty. It is evident that special attention should be given to this important phase of power distribution.

I am quite in accord with the last paragraph of Mr. Whitehouse's letter, and consider that every thought and energy expended to ensure continuity of supply is repaid by the increased confidence of the consumers and the consequent increase in business.

G. B. Burrows.

October 19th, 1908.

In reply to the second paragraph of Mr. W. P. Whitehouse's letter on the above subject: as it did not come within the scope of the article, I considered it superfluous to mention that the Board of Trade rules had been complied with, and a duplicate supply was available. To open one switch and close another is the work of a few seconds. Mr. Whitehouse's assumption, therefore, that this important supply was interrupted for many hours, causing great loss

to all concerned and the possibility of loss of a customer or two to the Power Co., did not exist. Another slip!

J. Hardie McLean.

Birmingham, *October 20th*, 1908.

A Compulsory Stop.

My attention has been called by many exhibitors at this Exhibition to your paragraph "A Compulsory Stop," on page 663 in your issue No. 1,612 of the 16th inst. Such items of news in the halfpenny Press, with penny-a-line reporters, one takes no notice of, but they are all at one with me in expressing surprise that a technical journal of your standing should insert such a paragraph without first ascertaining the true facts of the case. What really happened was this:—

Twice prior to October 1st, I had been carried past the Board of Trade compulsory stop without the car attempting to stop; on this occasion the same thing happened, and on coming down the steps from the upper deck I asked the trolley lad (the conductor being inside) to stop the tram, whereupon he rang the bell once. Now, as everybody knows, one ring will not stop a tram except at the next recognised stopping place, and having failed to stop at a compulsory stop, my contention was, and is, that the lad should have given the emergency ring. He told me, however, he was unable to stop; I then, rightly or wrongly, took hold of the trolley rope and pulled the trolley off the wire, the trolley boy grasped the rope when it slipped from my hand and it is said broke a guard wire (not the trolley wire, as I think would be understood from "an overhead wire," as your report has it).

The unfortunate part of the thing was that when the case came on I naturally had to plead guilty of the charge which, so far as I remember, was of having "removed a certain part of a certain tramcar, using a certain tramroad there situate," peculiar phraseology and very vague, but I expect I did it, and having a Solicitor I could not myself cross-examine the witness, John Fishwick, who stated that the trolley which I removed was in such a position as to endanger any car coming in an opposite direction. Now, although this undoubtedly prejudiced the Magistrate, it could not have been a fact, as you will know, the pole having self-centring springs, and having been pulled off on the near side, would naturally when released spring up and remain on the near side. There is no doubt in my mind that it is a practice of the drivers on this line to ignore the Board of Trade stops, as on the morning of the 15th inst., the day after this case was heard, car No. 214, going from the city, went past this same B. of T. stop just as a friend and I arrived there, without attempting to even slow down. What are Board of Trade stops for, anyway?

Having in a light-hearted way published the previous notice, I trust you will find room for my version.

Monté Callow.

[With pleasure; but it seems to us that our correspondent has practically confirmed our report in every respect. He took the law—and the rope—into his own hands, and suffered the natural consequences of his impatience.—Eds. E.R.]

Soft Iron.—A correspondent wants to know where the very softest wrought iron, with the minimum residual magnetism, can be obtained.

Safety Box.—A correspondent wants the name of the maker of safety boxes for packing arc lamp globes.

Patent Insurance.—Messrs. Ernest A. Notcutt & Co., general insurance brokers, of 27, Cannon Street, E.C., by arrangement with an insurance company, have just initiated a new scheme of insurance against financial loss consequent upon disputes in connection with patents and trade marks. They issue a policy covering all liability incidental to any infringement and all legal expenses consequent thereupon.

FAULTS ON TRACTION FEEDERS.

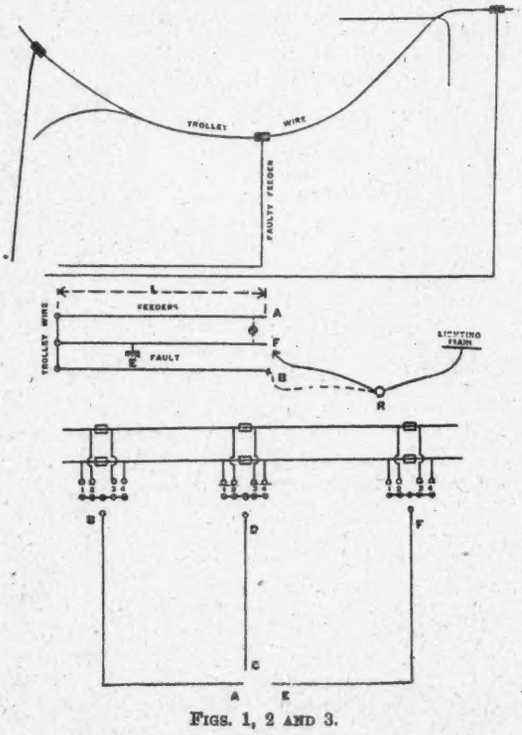
I give the following test for what it is worth to those who may be similarly situated to myself:—

Having had a fault develop on one of the traction feeders the night before the holidays, I had to turn out in a hurry to localise and repair it as quickly as possible. Being rather handicapped in the way of testing apparatus, such as resistance boxes, &c., I had to resort to a fall-of-potential test, using the lead as my return, but on testing I was not satisfied with the results obtained, for on varying the current the results did not come out in proper proportion. It then occurred to me to treat it as a three-wire distributor—that is, I took the feeder on each side of the faulty one to represent the outers, and the faulty one to be the middle wire; then the trolley wire became the short-circuiting piece, as in fig. 1.

By this means I was able to make a satisfactory test, and the feeder was connected up in time to take its share of the holiday load.

The test carried out was as follows, as soon as the traffic was closed down for the night (see fig. 2):—

A lead was taken from one of the outers on the lighting board, through resistance R to the faulty feeder F, and the



Figs. 1, 2 and 3.

volts taken across A F, giving reading V_1; next the lead from the resistance was connected to B, and the volts again taken across A F, giving reading V_2.

The length of the feeder being L, the distance of the fault from the station was $\frac{L}{V_1 + V_2} \times V$.

A satisfactory check reading was obtained by sending the current through A instead of B, and taking the volts across B F for reading V_3. In this case, a single 8-c.p. lamp was used as a resistance, and a moving-coil ammeter as a low-reading voltmeter.

The great advantage of testing in this way was that the whole of it could be done from the station, which is a very great advantage when the testing has to be done between the hours of 12.30 a.m. and 4 a.m.; the only thing that it was necessary to send out for was to put the switch (connecting the feeder to trolley wire) back in the disconnecting box of the faulty feeder.

Of course, a greater difficulty would be experienced when the faulty feeder was on an outlying district, and had not a feeder on each side of it, as in fig. 3. Then the fall of

potential along the trolley wire would have to be taken, unless the arrangement of feeding were such that one could arrange it as shown in fig. 3; that is, suppose A B to be the faulty feeder, and the feeding of the trolley wire to be as shown, then C D and E F are the other feeders respectively. In the box at B leave in Nos. 3 and 4 plugs, and in the box at D leave in No. 1 plug, take Nos. 2 and 3 off the bar, and join them together, then the box at F could be left as it stood; it will, of course, be clearly seen that this could not be done if there were any crossings or connections across from the trolley wires between the boxes B and D.

It is found that, the smaller the current used in the above tests, the better are the results obtained; the writer always uses, whenever possible, a single 8-C.P. lamp, and a low-reading voltmeter such as a rail-bond testing set, but in the above case the rail-bond set was in hospital.—H. H. J.

FRANCO-BRITISH EXHIBITION AWARDS.

From the exhaustive official list of awards issued last week, and published in several daily papers on October 15th, we extract the following particulars of awards that have been made for exhibits of electrical interest:—

Classes 1-6—*Group of Education.*

Diploma for Grand Prize.—National Physical Laboratory; Cambridge Scientific Instrument Co.; Sir J. W. Swan; Dr. J. A. Fleming; Sir W. H. Preece; G. Marconi; Prof. Ayrton; Prof. Perry; Johnson, Matthey & Co.; Eastern Telegraph Co.

Diploma for Gold Medal.—Marryat & Place; Pacific Cable Board; India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.; Lord Rayleigh; Sir Wm. Ramsay, K.C.B.; Dr. R. T. Glazebrook.

Diploma of Honour—Alfred Apps, Ltd.; Isenthal & Co.; General Electric Co., Ltd.; Prof. Callendar; Sir Oliver Lodge; Prof. A. Gray (University of Glasgow).

Class 15—*Mathematical and Scientific Instruments. Group* 3.

Diploma for Grand Prize.—National Physical Laboratory; the University College; Prof. Callendar; Cambridge Scientific Instrument Co., Ltd.; W. F. Stanley & Co.

Diploma of Honour.—The Reason Manufacturing Co.

Diploma for Gold Medal.—A. G. Thornton.

Class 16—*Medicine and Surgery.*—Diploma for Gold Medal, Ozonair, Ltd.

Class 17—*Musical Instruments, &c.*—Diploma for Silver Medal, Harper Electric Piano Co., Ltd.

Class 19—*Steam Engines, Condensers, Boilers, Feed Heaters, Superheaters, and Steam Engine Accessories. Group* 4.

Diploma for Grand Prize.—Mather and Platt, Ltd.; Babcock and Wilcox; British Mannesman Tube Co.; W. H. Allen, Son and Co., Ltd.; C. A. Parsons & Co., Ltd.; Parsons Marine Steam Turbine Co., Ltd.; Stewart & Lloyds, Ltd.; Wm. Beardmore and Co., Ltd.

Diploma for Gold Medal.—Beldam Packing and Rubber Co.; Aspinall's Patent Governor Co.; Clay Cross Co.; Körting Bros; Wm. Geipel & Co.; Royles & Co.; Small & Parkes, Ltd.; John Stewart & Son; Musgrave & Co.; United Asbestos Co.; W. H. Bailey & Co., Ltd.

Diploma for Silver Medal.—Lamp Pump Syndicate, Ltd.; J. P. Hall & Sons; Lassen & Hjort.

Diploma for Bronze Medal.—Andrews Governor Patents, Ltd.

Diploma for Honourable Mention.—Hobdell, Way & Co.; E. Reader and Sons, Ltd.; Adjustable Cover and Boiler Block Co.

Class 20—*Engines, Hot Air, Gas, Compressed Air, Gas Producers. Group* 4.

Diploma for Grand Prize.—British Westinghouse Electric and Manufacturing Co.; Crossley Bros., Ltd.; Mather & Platt, Ltd.; Power Gas Corporation; W. H. Allen, Son & Co.; Wm. Beardmore & Co., Ltd.; Davey, Paxman & Co.

Diploma of Honour.—National Gas Engine Co.

Diploma for Honourable Mention.—John Barker & Co.

Class 21—*General Machinery, Apparatus for the Transmission of Power, Recording Instruments, &c. Group* 4.

Diploma for Grand Prize.—W. H. Allen, Son & Co.; Vickers, Sons & Maxim; Mather & Platt, Ltd.; Joshua Buckton & Co. Ltd.; The United Flexible Metallic Tubing Co., Ltd; Glenfield and Kennedy, Ltd.; Cambridge Scientific Instrument Co.; Taylor and Hubbard.

Diploma of Honour.—Watson, Laidlaw & Co.; C. E. Heinke and Co.; Applebys, Ltd.; Thos. Broadbent & Sons, Ltd.

Diploma for Gold Medal.—Hans Renold, Ltd.; R. Waygood and Co., Ltd.; W. H. Bailey & Co., Ltd.; United Asbestos Co., Ltd.; Pulsometer Engineering Co., Ltd.; F. Reddaway & Co., Ltd.; Thomas Parker, Ltd.; "Bat" Meter Co., Ltd.; R. and J. Dick, Follows & Bate, Ltd.; W. and T. Avery, Ltd.

Diploma for Silver Medal.—Lamp Pump Syndicate.

Diploma for Bronze Medal.—"Auto" Recorder Co; Barlow's Patent Lift Co.

Class 22—*Machine Tools, Metal Working Plant, &c. Group* 4.

Diploma for Grand Prize.—Alfred Herbert; J. Hetherington and Sons, Ltd.; W. F. Stanley & Co., Ltd.

Diploma of Honour.—Watson, Laidlaw & Co.; Joseph Rhodes and Sons; J. Holroyd & Co., Ltd.; Sanderson Bros. & Newbould, Ltd.

Diploma for Gold Medal.—Louis Hervé; Selig, Sonnenthal and Co.; Hans Renold, Ltd; Colchester Lathe Co.; Rowland & Co., Ltd.

Diploma for Silver Medal—Stirk & Sons, Ltd.; John Barker and Co., Ltd.

Diploma for Bronze Medal.—Clipper Belt Hook Co.

Class 23—*Mechanical Production and Utilisation of Electricity Dynamos, Motors, Transformers, Application of Electricity to Mechanical Purposes, Safety Appliances. Group* 23.

Diploma for Grand Prize.—C. A. Parsons & Co.; Mather & Platt, Ltd.

Diploma of Honour.—W. H. Allen, Son & Co., Ltd.; Reyrolle and Co.; Lancashire Dynamo and Motor Co., Ltd.

Diploma for Gold Medal.—Adams Manufacturing Co., Ltd.; Electromotors, Ltd.; Simplex Conduits, Ltd.; United Asbestos, Ltd.; Watson, Laidlaw & Co.

Class 24—*Electro-Chemistry. Group* 5.

Diploma for Grand Prize.—Sherard Cowper-Coles & Co.

Diploma for Gold Medal.—Berry, Skinner & Co.; Ozonair, Ltd.; Dr. H. F. S. Sand.

Class 25—*Electric Lighting, Lamps, Regulators, Switches and Installation Accessories. Group* 5.

Diploma for Grand Prize.—C. A. Parsons & Co.; W. H. Allen and Co.; Edison & Swan U.E.L. Co., Ltd.; Reason Manufacturing Co.; Davis & Timmins; Simplex Conduits; London Decorative Metal Works, Ltd.

Diploma of Honour.—Linolite Co.; Wm. Geipel & Co.; Sunbeam Lamp Co., A. P. Lundberg & Son; Humbert & How; United Asbestos Co; Reyrolle & Co.; British Westinghouse Electrical and Manufacturing Co.; Stearn Electric Lamp Co., Berry, Skinner and Co., Louis Hervé.

Diploma for Gold Medal.—Wellman, Seaver & Head, Ltd., Westminster Engineering Co., Ltd.; Birmingham Guild of Handicraft.

Diploma for Silver Medal.—Galsworthy, Ltd., Imperial Lighting Co.

Diploma for Bronze Medal.—John Dugdill & Co., Watson, Duncan and Co.

Class 26—*Telegraphy and Telephony. Group* 5.

Diploma for Grand Prize.—Dr. J. A. Fleming, F.R.S.; Marconi's Wireless Telegraph Co.

Diploma for Gold Medal.—C. E. Heinke & Co.

Diploma for Silver Medal.—Caleb Code Condenser.

Class 27—*Various Appliances of Electricity. Group* 5.

Diploma for Grand Prize.—Dowsing Radiant Heat Co., Ltd.; Cambridge Scientific Instrument Co.

Diploma of Honour.—Bastian Meter Co., Ltd.; Reason Manufacturing Co., Ltd.; Alfred Apps.

Diploma for Gold Medal.—Rashleigh, Phipps & Co., Ltd.; Bergtheil & Young, Ltd.; Kinetic Swanton Co., Ltd.; Prof. Townsend; Dr. F. Mollwo Perkin; Marryat & Place; Dr. P. E. Shaw.

Diploma for Silver Medal.—Rochdale Electric Co., Ltd.; Purcell and Nobbs; Reynolds & Branson.

Class 30—*Carriages and Wheelwrights' Work and Automobile Inventions, &c.*

Diploma for Gold Medal.—W. H. Bailey & Co., Ltd.; F. Reddaway & Co., Ltd.; I. Frankenburg & Sons, Ltd.

Class 55—*Appliances and Processes used in the Manufacture of Food Products.*

Diploma for Gold Medal.—Ozonair, Ltd.

Class 65—*Metal Working, &c. Group* 2.

Diploma for Grand Prize.—Johnson, Matthey & Co.

Class 66—*Fixed Decoration of Public Buildings and Houses. Group* 12A.

Diploma for Bronze Medal.—London Decorative Metal Works.

Class 74—*Apparatus and Processes of Heating and Ventilation. Group* 12B.

Diploma of Honour.—Ozonair, Ltd.

Class 99—*India-Rubber and Gutta-Percha Industries. Group* 15.

Diploma for Grand Prize.—F. Reddaway & Co.

Diploma for Gold Medal.—R. & J. Dick, Ltd.

SOME RESULTS OF EXPERIENCE WITH ELECTRICALLY-DRIVEN ROLLING MILLS.

By C. KOETTGEN, M.Inst.C.E., and C. A. ABLETT, B.Sc., A.M.Inst.C.E.

(*Abstract of paper read before the* Iron and Steel Institute, *September*, 1908.)

The employment of electric power for rolling-mill driving offers great facilities for the exact measurement of the power required for different classes of work, and enables the knowledge as to how the power varies for different sections, and how it is affected by variations in temperature and quality of the metal, to be widely extended. A series of records is shown in fig. 1 for a sheet mill, and from these the exact value of the power required during each pass can be seen. Such results are almost impossible to obtain from a steam engine.

In many Continental mills advantage is taken of the integrating meters to keep daily records of the tons rolled of various sections and the kilowatt-hours required, so that the cost of rolling each section is known exactly.

The following figures show the power required for rolling different sections, from results obtained from over 150 rolling mills equipped by the Siemens Companies.

The high values for the kilowatt-hours per ton rolled, for the channels and tees under reference Nos. 11-14, may be chiefly attributed to the cooling of the section towards the last passes, the temperature coming down to about 850°. This cooling is due to the large surface which the section presents in proportion to its weight. In addition, these sections require more passes than the simpler square or round bars; the channels, for instance, are given 13 passes as compared with six for the round bars.

No.	Type of section.		KW.-hours per ton.	Final length.	Weight of billet.	Dimensions of billet.
				Feet.	Lb.	Inches.
1.	Flanged mine rails	28 lb. per yd.	37·5	92-97	860-910	5·1×5·7
2.		24 lb. per yd.	41·8	68-94	550-760	,,
3.		20 lb. per yd.	44·5	130	660-875	,,
4.		18 lb. per yd.	47·5	90-135	550-815	,,
5.		12 lb. per yd.	48·6	87-135	353-547	4·3×4·7
6.		8 lb. per yd.	54	113-139	330-375	,,
7.	Round bars, 1·2 in. dia.		38·3	89	327	5·1×5·1
8.	Round bars, 1·7 in. dia.		40·3	43·5	287	,,
9.	Square bars, 0·8 in. sq.		42	82	165	,,
10.	Square bars, 1·4 in. sq.		28·8	51	335	,,
11.	Channels, 1·57×0·79×0·2 in.		63·50	98	187	,,
12.	Channels, 1·18 × 0·59 × 0·16 in.		111	105	154	,,
13.	Tees, 1·2×0·16 in.		136	82	110	,,
14.	Tees, 1·38×1·8 in.		63·2	88·5-92	155	,,
15.	Flats, 2·35×0·4 in.		33·3	98	330	,,
16.	Flats, 1·95×0·4 in.		41·5	106	294	,,
17.	Flats, 1·5×0·32 in.		52	105	176	,,
18*	Sheets, 42×95×0·09 in.		84	—	388	7·9 sq.
19†	Sheets, 51×147×0·22 in.		95	—	450	33·5×15 ×4·7
20*	Sheets, 48×88×0·1 in.		80·0	—	415	6·7 sq.

* Three sheets were rolled from each billet.
† One sheet was rolled from each billet.

The results for the sheets under reference Nos. 18, 19 and 20 also show large values for the KW.-hours per ton. This is due to the large number of passes required, and to the rapid cooling of the sheets owing to the large surface which they present. The temperature of the metal before the first pass ranged from 1,183° to 1,250°, while at the last pass it had come down to 800°.

Such results as the above are of considerable assistance in settling the correct size of the motor for a new mill for a certain required output of similar sections.

Taking as an example the result for the 24-lb. flanged mine rails given in the table under reference No. 2, the average output of the motor during the day will be 700 H.P.

A 700-H.P. motor, however, would not be found large enough to drive this mill, as it is working more or less intermittently; the mill was driven by a motor capable of giving 1,200 B.H.P. continuously.

The necessary power which the motor has to give is not so great as the maximum power required by the rolls if a fly-wheel is employed. Continuous records, such as are shown in fig. 1 for a sheet mill and in fig. 2 for a rail mill, show how the maximum power required for the heaviest pass may be expected to exceed the mean power. For instance, it will be seen from the lower curve in fig. 1 that the maximum power taken by the motor was 650 KW., while the average power was 368 KW.

Experience shows it to be desirable that the motor should be able to give as a maximum overload a torque corresponding to twice its normal full load rating.

If the motor and mill are to give their maximum output, the passes should be so arranged that the torque which the motor is giving is constant as long as the motor runs at about the same speed.

In order that the fly-wheel may equalise the fluctuations in the power, the speed of the motor and fly-wheel must fall as the maximum power is required, to enable the fly-wheel to give up its stored energy, and the fly-wheel regains its stored energy in the interval between the passes. With a direct-current motor, the necessary fall in speed can be obtained by using a compound winding, but with a three-phase motor a resistance must be inserted in the rotor circuit, which increases the slip of the motor.

Fig. 1 illustrates the effect of the fly-wheel in reducing the fluctuations of power on a three-phase motor driving a sheet mill. The top curve shows the fluctuations of power when the slip resistance was cut out, so that the fly-wheel could not fall appreciably in speed and give any beneficial effect. The lower curve shows the variation in power when the slip resistance was adjusted to its proper value.

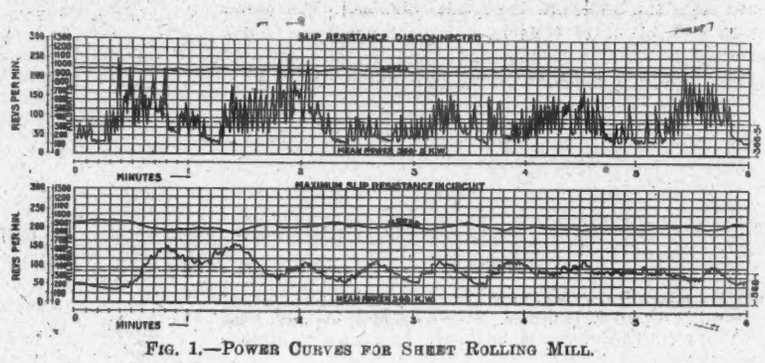


Fig. 1.—Power Curves for Sheet Rolling Mill.

The curves of fig. 2, in which the proportion of the maximum power which is given by the fly-wheel is shown, were drawn from records taken on a 1,200-H.P. three-phase motor, direct-coupled to a three-high mill having three pairs of housings, rolling flange rails of light section. The top curve A shows the electric power taken from the supply circuit as measured by the ammeter. Curve B shows the variation in speed of the motor and the fly-wheel, which had a moment of inertia of 58·5 foot-tons. These two curves are simultaneous records of the recording meters. Curve C shows the variation in the stored energy of the fly-wheel given in horse-power seconds, and calculated from the moment of inertia of the fly-wheel, and the speed as given in curve B. Curve D shows the power given out by the fly-wheel or absorbed by it as it decreases or increases in speed. In curve E the dotted curve is a reproduction of curve A, which shows the power taken from the supply circuit. The full line curve shows the actual power required by the rolls, and is obtained from the dotted curve by adding or subtracting, as the case may be,

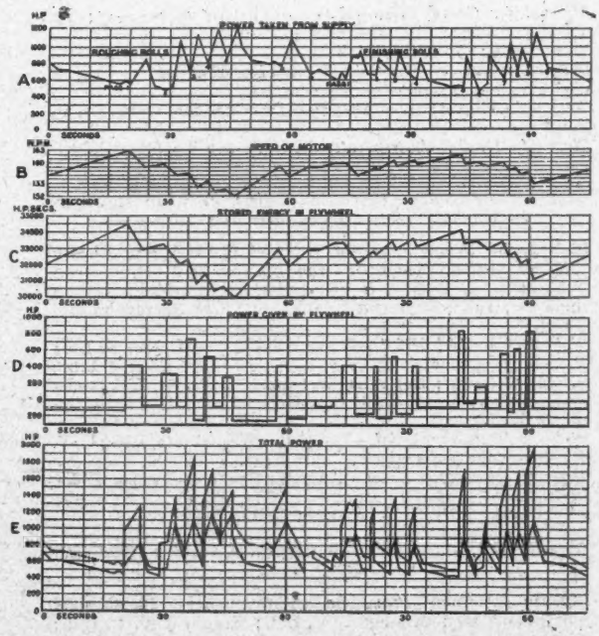


Fig. 2.—Power Curves Obtained from Rail Mill.

the values of the power given out or absorbed by the fly-wheel which are shown in curve D.

These results show that the fly-wheel has reduced the maximum power which the motor is required to give from 1,980 H.P. to 1,200 H.P., while the maximum variation in speed was from 163 R.P.M. to 152 R.P.M., or about 7 per cent. variation.

A fly-wheel is most suitable for equalising fluctuations in power where the maxima only last a very short time. In such a case as a looping-mill, where the metal may be in the rolls for several minutes, it is practically impossible to obtain any equilisation with the aid of a fly-wheel, and the motor must be large enough to give the maximum power required. It frequently happens that some of the passes follow each other in such quick succession that the fly-wheel cannot regain the speed in the interval between the passes which it lost during the pass, and so it will gradually drift downwards in speed until there is a succession of lighter passes or passes following at slower intervals. Such a drifting down in speed is very clearly shown in passes 1-5 of the roughing mill in curve B of fig. 2.

Care should be taken that the fly-wheel does not drift down in speed too much, otherwise an excessive fall in speed may take place, causing delay.

Where a three-phase motor is used, and the fall in speed is obtained by placing a slip resistance in the rotor circuit, a loss of power takes place in the resistance. In consequence of this, with a three-phase motor, a less fall in speed is usually allowable than is the case with a direct-current motor, and consequently a heavier fly-wheel has to be used to give out the same amount of energy. The slip should be selected so that the combined cost of loss of power wasted and capital charge on the fly-wheel is as small as possible.

It is sometimes stated that the loss of power can be avoided by providing an automatic arrangement, by which the slip resistance is only connected in the rotor circuit when the load is such that the current taken by the motor exceeds a predetermined limit and is switched out again when the maximum load is passed.

There is not, however, the saving in efficiency which would appear at first sight, as the slip resistance remains connected in circuit during the periods of maximum load (when the power lost is also a maximum) whether it is provided with an automatic arrangement or not, and it is only switched out of circuit during the periods of minimum load, when the loss of power is comparatively small.

It is almost invariably found that when a steam engine driving a rolling mill is replaced by an electric motor a greater output is obtained from the mill, and that when a mill is installed for electric driving a correspondingly greater output is obtained than would be expected from the experience gained in steam driving.

The rail-mill, from which results Nos. 1-6 were taken, was installed for an output of 100 tons per day, but the results show that this figure has been considerably exceeded, and 150 tons per day have been obtained a good many times. The reason is that the speed of the electrically-driven mill remains very nearly constant, whatever work it is doing, and in this case the speed of the electrically-driven mill was much increased when the electric drive was installed.

The reason that so steady a speed can be obtained with electrical driving is partly due to the fact that the overload capacity of an electric motor is much greater than that of a steam engine, and partly because an electric motor responds instantaneously to any increased demands for power.

In order to gain the fullest advantage of an increased output by electric driving, the electrically-driven tilting or lifting tables should be arranged to work reasonably fast.

Experience has shown that it is very desirable that motors of large size should drive through a flexible coupling.

Recently several tests have been made on reversing cogging-mills to ascertain the work required to roll out ingots to different elongations. The electrical equipment for a reversing-mill may be briefly described as consisting of an Ilgner fly-wheel converter set and a reversible mill-motor.

The Ilgner fly-wheel converter set, which runs continuously in one direction and requires practically constant power, is driven from the source of supply, and consists of one or more variable voltage dynamos which supply current at varying voltage to the reversing-mill motors, and a fly-wheel which equalises the variations in the power required by the reversing-mill motors.

This electrical equipment is working economically in the sense that the greatest output is obtained for a given capital outlay, if the draughts are taken so that the motor is giving constant torque at each pass, this torque being the maximum working torque of the motor.

If the torque in one pass largely exceeds that in the other passes, this simply shows that it will be possible to take bigger draughts in the other passes, and so the ingot could be rolled with fewer passes, and more output could be obtained, or else that a less draught should be taken in that particular pass so as to reduce the torque, and to enable a smaller motor to be put in.

The power required by the mill motors of a reversing rolling mill is continually varying from nothing to very high values, and the fly-wheel of the fly-wheel converter set is used to balance these variations of power, so that the motor of the fly-wheel converter set is practically taking constant power from the supply circuit. If the mill motor is giving constant torque during each pass, it will require much more energy during the last passes than during the earlier ones, as the ingot is becoming longer, and so takes longer to go through the rolls. It is advisable, therefore, to reduce the draught in the last few passes, the torque which the motor is required to give for these reduced draughts being correspondingly reduced.

INTERNATIONAL CONFERENCE ON ELECTRICAL UNITS AND STANDARDS, 1908.

The proceedings of the Conference were opened at the rooms of the Royal Society, Burlington House, on Monday, October 12th. The delegates were received by the Right Hon. W. S. Churchill, President of the Board of Trade, who delivered an address, to which M. Lippmann (the Sorbonne) and Prof. Warburg (Charlottenburg) briefly replied. Mr. Churchill then suggested that the draft Rules of Procedure employed at the Conference on Wireless Telegraphy, at Berlin, should be adopted, and on this having been done, Mr. Churchill, as representing the British Government, in accordance with the rules, nominated Lord Rayleigh, President of the Royal Society, as President of the Conference, and withdrew. Lord Rayleigh nominated vice-Presidents as follows:—Dr. S. W. Stratton (America), Dr. V. Edler von Lang (Austria), Prof. S. A. Arrhenius (Denmark and Sweden), M. Lippmann (France), Dr. Warburg (Germany), and Dr. M. Ederoff (Russia); and secretaries: Mr. M. J. Collins, Mr. W. Duddell, F.R.S., Mr. C. W. S. Crawley, and Mr. F. Smith.

On the proposal of the President, Australia, Canada and India were accorded votes, and it was decided that the meetings should be open to the Press.

A Technical Committee was appointed to draft specifications and to consider questions referred to it by the Conference, consisting of the following members: Dr. Stratton, Dr. Carhart, Dr. Rosa, M. Gérard, Prof. Arrhenius, M. Lippmann, M. de Nerville, M. Benoit, Dr. Warburg, Dr. Jaeger, Dr. Lindeck, Lord Rayleigh, Dr. Glazebrook, Mr. A. P. Trotter, Prof. Roiti, Dr. Haga, M. Egeroff, Dr. Weber, Prof. Threlfall, Major Cardew, Dr. Chappuis, and Dr. Kusminsky.

Mr. A. P. Trotter then moved that the magnitudes of the fundamental electrical units should be determined on the electromagnetic system of measurement with reference to the C.G.S. units of length, mass and time. This was seconded by Dr. Stratton and carried unanimously.

Consideration of the second resolution, introducing the recommendations of the Conference, was postponed, and the third resolution was moved by Prof. Warburg: "The International ohm shall be defined as the resistance of a specified column of mercury." Some discussion followed on the distinction between a unit and a standard, the President pointing out that the ohm, as defined in absolute measure, could be arrived at with a very great degree of precision—not much less than that with which the resistance of a column of mercury could be found. The resolution was carried unanimously, and Prof. Warburg moved that: "The international ohm is the resistance offered to an unvarying electric current by a column of mercury at the temperature of melting ice, 14·4521 gm. in mass, of a constant cross-sectional area and of a length of 106·300 cm." The essence of this clause lay in the insertion of the two ciphers after the 3. Dr. Rosa suggested that the length of the column should be defined as 1 metre, and the mass altered to 12·7890 gm. There would then be only one figure to alter (that defining the mass) in the event of a change in the specification, instead of two, as at present.

Mr. A. P. Trotter remarked that the two zeros after the figure 3 had no scientific meaning, and that the new specification gave to scientific workers no information at all. The proposed change was inappreciable to the electrical industries, and the adoption of a mercury standard was opposed by a large number of scientific men. A *useful* result of the Conference would be an organisation for the comparison of the standards of different countries. He was in favour of wire standards, though they were by no means perfect. It seemed likely that the Lorenz or some other method would soon enable the determination of the value of the ohm to be made to a few parts in 100,000; when that time came, mercury columns might be sent to the museums. Dr. Warburg argued in favour of continuity, the international ohm was sufficiently near the true ohm for technical purposes, and its value should never be changed, though its relation to the true ohm might always be open to scientific inquiry. Other speakers discussed Dr. Rosa's suggestion, which was seconded by Prof. Arrhenius, and was eventually referred to the Technical Committee by a majority of 16 to 5, two countries not voting. The Conference was then adjourned to Wednesday.

At the second meeting of the Conference, Lord Rayleigh read a letter written on behalf of His Royal Highness The Prince of Wales. The secretary announced that the President, under Article V. of the Regulations, was pleased to admit Mr. S. S. Traustel and Mr. Lebedeff to the meetings. The presence of Mr. Weiss (Brazil) was announced, and the names of Dr. Asano (Japan) and M. Clément (Belgium) were added to the Technical Committee.

The resolution on the second primary standard—the most important matter before the Conference—was then moved by Dr. Glazebrook. From a comparison of all the values obtained for the electro-chemical equivalent of silver, he drew the conclusion that this standard could certainly be considered permanent and accurate; this was further confirmed by the fact that the Board of Trade ampere balance, which was adjusted 14 years ago to the value 1·118, when tested recently gave the equivalent of silver 1·1179, an extremely good agreement. As further reasons for adopting the ampere as the second primary unit, he pointed out that the absolute determinations of the ohm and the ampere were quite independent, and that in current measurements the value of resistances did not affect the results.

In favour of the ampere standard only one chemical need be pure, differences in the form of the apparatus were unimportant, no time was required between setting-up and use, secondary reactions were of small importance, and practically no temperature coefficient existed.

As a concrete standard he considered the cell certainly better, but, in a standardising laboratory, the voltameter could be set up more easily than the cell; further, when cells were set up from a specification by an ordinary careful worker, the results were very far from satisfactory.

The cell and a resistance would still be used for measurements of current, but he was opposed to the adoption of the cell as the second standard, as in the past it had been neither permanent nor reproducible; in fact, the values for the Clark cell had varied from 1·434 (Lord Rayleigh) to 1·4322 (Kahle and others) in later years.

Even with the Weston cell there was a difficulty in obtaining exactly accordant figures. There were four chemical substances in the cell, of which one was difficult to prepare satisfactorily.

Of between 300 and 400 cells set up at the National Physical Laboratory, 80 per cent. agreed to within 3 or 4 parts in 100,000, but in the remaining 20 per cent. the differences might attain to 2 in 10,000. Many of the cells changed with time, due possibly to instability of the mercurous sulphate.

Dr. Warburg seconded the resolution.

Prof. Lippmann proposed an amendment that "the volt is the second primary unit"; he pointed out that everybody would use the cell in practical work, and that when Dr. Glazebrook used a cell in the measurement of current, he acted illegally under the proposed resolution. Prof. Lippmann considered that the volt was independent and could be measured absolutely by means of a disk rotating in the earth's magnetic field.

Prof. Carhart, in seconding Prof. Lippmann's amendment, pointed out that the great Congress of 1881 proposed the ohm and volt as standards, and in practice the ohm and volt were used. It was not correct to say that the volt could not be determined absolutely, but only that it had not been done. The silver coulombmeter was laborious, and required a long time to make a series of measurements. Lord Kelvin, who used a copper coulombmeter for many years, gave it up in favour of a cell and resistance. Whatever was decided, cells would be used in trade and commerce, and they were amply sufficient in reliability for practice.

Prof. Warburg said that if the cells were not checked against the voltameter there was an uncertainty; if they were checked, then an ampere standard existed. As against the cells, the mercurous salt was not well defined, and many cells gave abnormal results. Great confusion would arise from the adoption of the volt.

Mr. Trotter explained how the silver voltameter had been employed in the past to check the standard Board of Trade balance, and mentioned the good agreement which still existed.

Prof. Rosa said that they should never again fix three quantities, as at Chicago, as Ohm's law was exact and rigorous. He contended that the voltage of the cell at 20° C. should be defined and fixed, and that an uncertainty must be permitted in one value or the other; as the electro-chemical equivalent of silver was less often used, it should be in the figure ·001118.

Cells agreed with one another to a greater accuracy than they could be checked against the coulombmeter, and there was every reason to believe that cells would have the same E.M.F. year after year when set up. Even if the life were short, no difficulty would result. He quoted data to show that a certain batch of cells had settled down within five days; he expected they would remain good for two years or more. Although the mercurous sulphate might be prepared by various methods, cells would be rarely out by more than three parts in 100,000 from the mean value. The silver coulombmeter was not a concrete standard; it was not portable, and it was laborious to compare cells with it. As to the choice between Clark and Weston, it was felt that the Clark might possibly be more stable. He thought it safe to take the Weston as quite constant to one part in 10,000, and that the hysteresis and temperature lag were very small.

M. Eric Gérard said that, as representing one of the countries that had legalised the ampere, he would require to give his Government strong reasons in favour of a change, and no such reasons had been brought forward.

After further discussion, Resolution V, "That the ampere is the second primary unit," was put to the meeting; all the countries voted, and the resolution was carried by 19 to 4.

Dr. Glazebrook then formally moved Resolution VI:—

"The international ampere is the unvarying electric current which when passed through a solution of nitrate of silver in water, in accordance with the specification attached to these resolutions, deposits silver at the rate of 0·00111800 of a gramme per second." Prof. Warburg seconded this resolution.

Prof. Lippmann moved an amendment that "the international ampere shall be defined as 1/10 of the electromagnetic unit on the C.G.S. system." In favour of this, he pointed out that it would not compel laboratories to use the silver voltameter.

Dr. Carhart seconded Prof. Lippmann's amendment, and Dr. Glazebrook stated that if the international ohm had been defined in terms of the C.G.S. system, Prof. Lippmann's amendment would have had his hearty support.

The President said his sympathies were with the C.G.S. system, but that it would be inconsistent to have a C.G.S. ampere and a mercury ohm. The amendment of Prof. Lippmann was then put to the meeting. All the countries voted; 2 for, and 21 against, and the President declared the amendment lost.

The question as to the exact figure for the electro-chemical equivalent of silver was unanimously referred to the Committee.

Dr. Glazebrook then moved Resolution VII, that "The international volt is the electrical pressure which, when steadily applied to a conductor whose resistance is one international ohm, will produce a current of one international ampere," which was seconded by Prof. Warburg, and carried unanimously.

The note on the Weston cell was referred to the Technical Committee.

A reply was sent to the Prince of Wales's message, and the Conference adjourned till Friday.

The first meeting of the Technical Committee was held on Tuesday, October 13th.

Prof. Warburg proposed that Dr. Glazebrook be chairman of the Technical Committee; this was seconded by Prof. Lippmann, and carried unanimously. Dr. Rosa's proposition was discussed, and, when put to the meeting, was negatived by 14 to 5, with one abstention.

The specifications were then considered paragraph by paragraph.

The following gentlemen were asked to form an informal sub-committee to consider the following points and to report to the Technical Committee on Thursday:—M. Benoit, Prof. Carhart, Dr. Jaeger, Dr. Lindeck, Dr. Rosa, Mr. Smith.

Specification A. Mercury Ohm.—Shall the ends of the tube be flat or convex?

The value of the constant a in the formula for the resistance of the tube.

Specification B. Deposition of Silver.—The necessity for limiting the amount of silver deposited to 15 per cent.

Specification C. Weston Cell.—The correct value for the figure following the "8" in the 1·018 for the voltage of the cell.

How best to reconcile the proposed formula for the voltage of the cell and the Wolff formula, or which is the more accurate.

The second meeting of the Committee was held on Wednesday afternoon, to consider the exact value to be taken for the electro-chemical equivalent of silver in Resolution VI, and the E.M.F. to be assigned to the cadmium cell in the Note; and a third meeting took place on Thursday morning when an interim report was drawn up.

The third meeting of the Conference was held on Friday, October 16th, all the delegates being present except Prof. Threlfall.

The Conference considered the interim report of the Technical Committee.

Dr. Glazebrook, as chairman of the committee, moved, and it was agreed, "That the Technical Committee be authorised to issue, as an appendix to the report, notes detailing the methods which have been adopted in the standardising laboratories of the various countries to realise the international ohm and the international ampere and to set up the Weston normal cell."

It was decided, on the recommendation of the Technical Committee, not to alter the length of the mercury column in the definition of the international ohm from 106·300 cm. to 1 metre.

Dr. Glazebrook then stated that it had been referred to the Technical Committee to consider whether the two zeros following the 8 in the amount of silver deposited per second should be altered to any other figures, and if so, what figures. When the Technical Committee came to consider this, considerable differences of opinion arose, and it had been thought better to refer the matter back to a plenary meeting of the Conference. The difficulty seemed to be that the international units were not identical with the C.G.S. units. This difficulty would still remain if the international units were only defined to four figures. The Conference would be a failure, and would neglect to answer one of the important questions put to it, if it did not definitely fix the international units. He submitted that a vote should be taken on Resolution VI.

In reply to Mr. Trotter, the Secretary said that 13 delegates voted in favour of four figures being sufficient, and 7 against.

Prof. Warburg supported Dr. Glazebrook, and seconded Resolution VI.

Discussion followed as to whether the figure should be 0·001118, 0·00111800 or 0·00111820. The President said that Resolution VI:—"The international ampere is the unvarying electric current which, when passed through a solution of nitrate of silver in water, in accordance with the specification attached to these resolutions, deposits silver at the rate of 0·00111800 of a gramme per second," was proposed and seconded and before the meeting: 21 countries voted in favour of the resolution, and three, namely, France, Italy and Canada, against the resolution, out of 24 countries present and voting.

The Conference next considered Resolution II, and it was resolved that the words "for purposes of trade and commerce" should be deleted, and the words "for the purpose of electrical measurements and as a basis for legislation" be substituted, the resolution then reading: "As a system of units representing the above and sufficiently near to them to be adopted for the purpose of electrical measurements and as a basis for legislation, the Conference recommends the adoption of the international ohm, the international ampere and the international volt defined according to the following definitions."

Twenty-one countries voted in favour of Resolution II, and three, America, Belgium and France, against; 24 countries being present and voting.

Dr. Glazebrook then proposed to add an additional resolution:—"That the ohm is the first primary unit," and it was accepted unanimously.

The Conference proceeded to consider the steps necessary to secure uniformity of the standards in future.

Prof. Warburg moved "That the Conference approves generally the draft scheme to establish a permanent commission to secure uniformity of administration in relation to electrical units and

standards in the future. The Conference refers the draft scheme to the Technical Committee to consider details and to nominate the first members of the Commission."

After some discussion this was agreed to, and the meeting adjourned to Monday, October 19th.

LEGAL.

British Westinghouse Co. *v.* Mersey Railway Co.

The Lord Chief Justice, in giving judgment, dealt first with the disputed point as to the right of the Mersey Co. to form a renewal fund to which they claimed to be entitled to allocate a certain sum half-yearly. The company sought to justify this on the ground that it was a prudent and necessary thing to do, and that the fund was authorised by the words of the contract. He thought the contention of the company could not be sustained. What the agreement authorised was the deduction from the gross revenue of all "fair and proper working expenses, establishment charges and all such other expenses as have hitherto been so charged in the company's accounts against gross revenue." He thought it was going too far to say that those words authorised the deduction from the gross revenue of sums to be allocated to a renewal account. To authorise such deductions in favour of a renewal account, however wise and prudent, would require special words in the contract, and he agreed with the umpire that the right to make these deductions did not arise under the words "working expenses." This point, therefore, must be decided in favour of the contractors. The second point was the question of set-off. The umpire held that there was nothing to exclude the contractors from availing themselves of the ordinary rules as to set-off, and he saw no reason to disagree with the umpire. The contractors were bound under the contract to pay certain sums as certified by accountants to the Mersey Co. for the payment of debenture interest, but the supply of goods or materials to the Mersey Co. was entirely outside the contract, and he could see nothing in law to preventing the contractors from setting off the price of those goods against the payments. That point also must, therefore, be decided in favour of the contractors. The third point was whether the company was entitled to damages for the non-payment of certain half-yearly payments which ought to have been made under the contract, and the non-payment of which made it necessary for the company to obtain the money elsewhere. In his opinion, the Mersey Co. were entitled to damages in regard to this failure to make these payments. The result was that, in his opinion, the contractors were entitled to succeed on the first two points and the Mersey Co. on the third.

Mr. Justice Bigham and Mr. Justice Walton concurred, and the case was remitted back to umpire accordingly.

Geipel and Another *v.* Russell and Another.

On Thursday, October 15th, in the King's Bench Division, before Mr. Justice Ridley and a special jury, the hearing was commenced of an action by Messrs. Geipel & Lange, electrical engineers, of the Vulcan Works, 72a, St. Thomas Street, Southwark, against Mr. R. Russell, trading as R. Russell & Co., of Dryad Street, Felsham Road, Putney, and Mr. R. Emerson, of Sutton Court, Chiswick. Plaintiffs claimed against Mr. Emerson, as acceptor, and Mr. Russell, as drawer, of two bills of exchange for £50 each, dated respectively March 26th and 29th, 1907, and payable four and six months after date, alleged to have been given for certain electric wiring. Plaintiffs also claimed £79 14s. 7d., balance of goods sold and delivered.

Defendants' case was that the plaintiffs were dealers in wiring apparatus for electric lighting, and the goods bought from them were sold on the condition or warranty that the wiring should be what was known as 600-megohm grade, merchantable and fit to be used for electrical purposes. The wiring was used by the defendants for the purpose of fulfilling certain contracts for the wiring of houses on the New Estate, Barnes. Defendants' allegation was that the wiring was defective, and that the plaintiffs were not entitled to payment. In consequence, it was alleged that a contract for the wiring of 300 houses on the same estate, and on which there would have been a profit of £1,200, was lost.

Plaintiffs denied that the wiring was sold on the condition or warranty that it would be of a certain standard quality.

Mr. Wm. Geipel, examined, said he was an electrical engineer, and it was part of his business to supply cable for electric wiring as well as electric fittings. There were three qualities of wiring sold by him, and they were known as 300 m., 600 m. and 2,500 m., which represented the degree of insulation resistance. India-rubber was the substance used for insulation. None of the men in his employment had authority to make any promise as to warranty, and there was no suggestion made that there had been a warranty until the affidavits were filed.

Mr. Saltrick, plaintiffs' manager, said the wiring was sold as a job lot. It was bought from sample and purchased as a job lot. Witness never said that if the wiring was not of a certain standard quality he would make good the loss. The sum of 9s. 6d. or 10s. 6d. per point would be a fair price for wiring. He thought it would be impossible to make a profit by making the price 5s. per point.

Several other witnesses who are in the employment of plaintiff having been called,

His Lordship held that there was no case against Mr. Emerson, and he dismissed the action as against him.

Mr. Compton-Smith, counsel for Mr. Russell, in opening the defence, said there was no complaint so far as he knew against Mr. Russell in reference to the way he had conducted his financial operations during the great number of years he had dealt with the plaintiffs. The result of purchasing the wire was that his client had lost an extremely valuable contract in addition to the wiring of 308 houses in the neighbourhood of Barnes. It was when the tenants took the wired houses that the complaints were addressed to Mr. Russell.

Mr. Robt. Russell (defendant) was then examined, and stated that he was an electrical engineer. After the wiring of houses at Barnes, and after they had been tenanted, complaints came to him continually. He wired an estate of houses at Merton, and he had complaints from the tenants there also.

Further evidence having been given for the defence as to the conditions under which the goods were purchased, the jury found for the plaintiffs for £141 10s.

Wolverhampton Corporation *v.* Graiseley Foundry Co.

At Wolverhampton Police Court on Saturday, the Graiseley Foundry Co., Ltd., Hallett's Row, were summoned for the non-payment of £14 7s. 5d. for the supply of electricity and fittings and the hire of a motor. The account, it was understood, ran from January 3rd to June 26th. It was elicited by the ex-Mayor, who was the presiding magistrate, that the defendants' lift account was still owing, whereupon the ex-Mayor remarked that he did not think the Electricity Committee of the Corporation were doing their duty in giving so much credit. An order was made for the payment of the amount forthwith.

The Traction Corporation and Robert Brown *v.* Samuel Green Bennett.

In this case which came before Mr. Justice Parker in the Chancery Division on Monday, the plaintiffs sought a declaration and other relief in respect of a patent taken out by the defendant, a draughtsman, at Chesterfield.

By their pleading plaintiffs asked for a declaration that the patent taken out by the defendant in October, 1905, in reference to a horizontal lever for surface contact, was in fraudulent prejudice of the plaintiffs' rights, and that the patent was bad by reason of disconformity between the provisional and complete specification, and for an injunction to restrain the defendant from in any way dealing with the patent; plaintiffs also claimed damages.

Mr. Walton, K.C., for the defence, took the preliminary objection that the action must fail, as plaintiffs had not asked for rectification, and they could not do so without the fiat of the Attorney-General.

Mr. Simpson, for the plaintiffs, said that all he wanted was a declaration that the patent was in prejudice of the plaintiffs' rights. On July 25th plaintiffs patented a horizontal level for surface contact; on August 12th defendant completed a full size drawing of it in which the horizontal lever was shown, and on October 14th filed his complete specification which contained the horizontal lever, though the provisional specification did not.

His Lordship said that the action must fail. Fradulent prejudice of a plaintiff's rights was a well-known ground for revocation, but circumstances which gave a right to revocation did not arise on the present statement of claim. The declaration he was asked to make would not give any right of relief at all. Plaintiffs admitted that they could not ask for an injunction, and he could not grant damages, and there was no allegation of fraud at common law. He therefore dismissed the action with costs.

PARLIAMENTARY.

London Electric Supply Bill.

In the House of Commons on Monday, it was moved, on the second reading of the above Bill, that it be an instruction to the Committee to which the Bill is referred, that they have power to insert a provision constituting the London County Council the purchasing authority on equitable terms, and, further, that existing purchasing authorities or any other persons affected by such a provision shall be entitled to be heard before the Committee upon any petition presented not later than October 22nd.

Mr. T. Lough had given notice to move that the word "equitable" be left out, and that after the word "terms" the following be inserted:—"Under which within six months of 21 years from the passing of the Act, and within six months after the expiration of every subsequent period of seven years, the Council may require the company to sell, and thereupon the company shall sell to them their undertaking upon terms of paying the then value (exclusive of any allowance for past or future profits of the undertaking or any compensation for any compulsory sale or other consideration whatsoever) of the undertaking and all lands, buildings, works, materials and plant of the company suitable to and used by them

for the purpose of their undertaking, such value to be, in case of difference, determined by an engineer or other fit person nominated as referee by the Board of Trade on the application of either party."

Mr. Timothy Davies also gave notice to move the following after second reading:—"That it be an instruction to the Committee to which the Bill is referred to insert a clause making it clear (1) that the companies shall not be entitled, in the event of the purchase of their undertakings, to any additional sum by reason of the exercise of the powers by this Act authorising agreements between the said companies for mutual assistance or association; and (2) that the companies shall not be entitled, in the event of the purchase of their undertakings, to any sum in respect of any loss occasioned by severance from such undertakings of any mains or works laid or constructed under the provisions of this Act."

The discussion took place in the House of Commons on Monday night. Sir H. Kearley, Parliamentary Secretary to the Board of Trade, moved the instruction given above. Mr. Rowlands moved an amendment to confer the purchasing powers upon a central authority composed of representatives of municipal electricity authorities within the area of the Bill. He raised very strong objection to the L.C.C. controlling a large area wherein municipal authorities already had their own supply. Why should Essex and Middlesex, as well as large parts of Kent and Surrey, be unrepresented? Mr. Whitehead seconded the amendment, and, after discussion, it was rejected by 174 votes against 86. Mr. Lough attacked the Government for allowing private promoters to interfere with the existing municipal supplies. After Mr. Churchill had replied, further remarks were offered, and Mr. Churchill then moved the closure. This was carried by the narrow majority of 9 (153 to 144). Subsequently the instruction was approved by 212 votes to 79, a majority of 133.

London Traffic.—In the "Parliamentary Papers," Mr. Carr Gomm asks the Prime Minister whether the Government will be able to deal with the question of London traffic during the coming winter; whether the special branch of the Board of Trade has presented its report on this matter; and whether the Government will set apart a grant for widening the London streets and improving the means of communication in connection with its proposals for the relief of unemployment in London. Mr. Asquith replies that he understands that the London Traffic Branch of the Board of Trade has presented its report to the Board, and that it will shortly be laid upon the table of the House. He cannot hold out any hope that legislation dealing with London traffic can be enacted during the present session.

BUSINESS NOTES.

Consular Notes.—Italy.—The Austrian Consul at Ancona, in a recent report, states that at Mazzano, on the Tronto, electrical works of 1,500 h.p. have been erected which are to be used for industrial and lighting purposes at Acquasanta, and to supply electrical energy to Ascoli Piceno and all the townships on the lower Tronto; an application has been made for permission to appropriate further power from the Tronto which will be used for traction purposes on the Ascoli-Teramo tramway. Another electrical station has been erected in Arquata del Tronto, near Capodacqua, to supply power for small industries, whilst the Societa Industriale Italiana propose to erect a station of 24,000 h.p. between Arquata and Acquasanta to supply power to an electro-chemical establishment.

The British Consul at Florence reports that the Valdamo Mining and Electrical Co., with a capital of £240,000, works some extensive lignite mines in the commune of Cavriglia, and large electric works have recently been erected for the purpose of using their own coal as fuel for the production of electrical power to be distributed for lighting, &c., to the neighbouring cities. Electrical energy will be conveyed to Florence, Prato, Siena and Arezzo by means of cables, which are now being laid. The current is to be transmitted at 33,000 volts pressure. The machinery has been partly supplied by the Westinghouse Co. and partly by German firms; the engines, &c., are of Italian manufacture. Its output of lignite is at present about 180,000 tons. There is a briquette factory adjoining. These works when complete and in full work, will hold one of the foremost positions in this branch of industry in Italy.

The British Vice-Consul at Elba reports that as an annexe to the Elba works at Portoferraio, an electric furnace for the production of calcium carbide will be driven by the power obtained from the central electric station above mentioned, and the valuable limestone deposits in the island will furnish excellent raw material for the manufacture. With the intention of utilising the electric power of the Elba works, a project has been mooted to lay an electric tramway line connecting Portoferraio with the mining centres of Calamita and Terranova. The line is to traverse the townships of Portolongone and Rio Marina, with the object of transporting the ore raised in those centres, establishing also a passenger service between the several towns and villages. Whilst no doubt can prevail as to the advantages of the proposed passenger service, it remains an open question whether ore can be handled profitably by rail, it being borne in mind that the producing mines and the consuming works both lie on the seaboard.

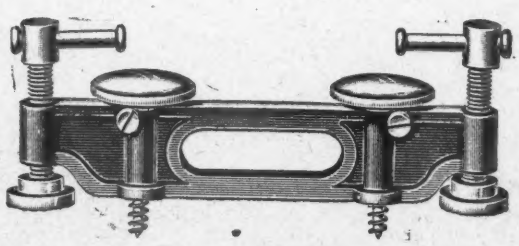
China.—The Austro-Hungarian Consul at Shanghai reports that the imports of machines and parts thereof in 1907 showed an increase. Deliveries for all kinds of plants and works, for Government arsenals and shipyards, and for large and small technical establishments which public and private parties have recently called into being, have caused an increase in the importation of these goods from year to year. The imports of machines and accessories in 1907, amounted to 23,806,510 fr., as against 23,631,701 fr. in 1906, and 21,155,545 fr. in 1905. Of the imports in 1907, 8,600,836 fr. were from the United Kingdom, 5,644,052 fr. from Germany, 4,941,388 fr. from the United States, 2,149,221 fr. from Hong Kong, 1,865.424 fr. from Japan, 400,514 fr. from Belgium, 117,943 fr. from Holland, and 10,576 fr. from Austria-Hungary. An increase was also shown in the imports of railway material, *i.e.*, locomotives, trucks, &c., excluding rails. The imports in this class amounted to 52,370,000 fr. in 1907, as against 47,132,000 fr. in 1906, and 27,771,000 fr. in 1905. Of the imports in 1907, 13,368,725 fr. were from the United Kingdom, 11,498,566 fr. from America, 11,000,118 fr. from Belgium, 8,926,405 fr. from Japan, 3,173,038 fr. from Hong Kong, 1,139,494 fr. from Germany. Electrical machines and installation materials were imported to a value of 4,673,744 fr. in 1907, as against 3,767,050 fr. in 1906 and 1,983,586 fr. in 1905. The imports in 1907 from countries were, Belgium 1,489,234 fr., United Kingdom 1,203,429 fr., Germany 860,331 fr., Japan 494,509 fr., Hong Kong 268,284 fr., United States, 221,821 fr., Austria-Hungary 3,034 fr. Telegraph apparatus and accessories (Morse telegraph apparatus with telegraph wires, Leclanché cells, &c.,) were imported to a value of 1,107,126 fr. in 1907, as compared with 2,304,777 fr. in 1906 and 2,548,030 fr. in 1905. Of the imports in 1907, 627,671 fr. were from the United Kingdom, 285,420 fr. from Japan, 266,500 fr. from Germany, 135,178 fr. from the United States, 73,084 fr. from Belgium, 42,245 fr. from Denmark, 462 fr. from Austria-Hungary. Complete machinery plants for the establishment of new undertakings were chiefly imported from abroad. These included plants for cotton spinning mills, silk mills, wheat milling, oil works, rice hulling works, paper works, and electrical and hydraulic works.

Corea.—The British Consul at Chemulpo reports that the Chemulpo Electric Co. proposes to construct an electric tramway to run past the jetty of the General Foreign Settlement to various parts of the Japanese Settlement and outside districts.

Spain.—The British Consul at Gijon reports that a large electric tip, erected at a heavy cost, has already begun to work in the port of Musel. It is not advisable as yet to hazard a statement as to the capacity of this tip, and alterations are already talked of as being necessary. The coal and minerals are tipped from the railway trucks into hoppers, which shoot their contents into large buckets carried on electric trolleys running on the low-level, which, on arrival at the ship's side, are picked up by a crane or transporter with a horizontal jib or arm, and carried over the ship's hatches. Another loading tip is in course of construction, which is of a more simple kind, as it will shoot the coal direct into the ship's hold. It is expected to be ready for operating at the end of 1908.

Turkey.—The British Consul at Salonica reports that a newly established electric tramway has taken the place of the horse-drawn tramway which previously existed. The rolling stock, imported from the United States, consists of 25 cars costing £720 each. They are long and lofty, are lighted by electricity, and accommodate 36 persons, including those standing on the platforms outside. A large generating station has also been built to supply energy to the cars by the overhead trolley system. The electric tramway service of Salonica, as well as the horse-drawn tramway which preceded it, is due to Belgian enterprise, as is also the water company. It remains to be seen whether electric light will be installed by the municipality or by private persons, who seem to be deterred by fear of the heavy initial expenditure.

Floor Lifter.—The Ajax floor lifter is a handy little tool, which will pack into any tool bag. It will take up the most obstinate floor board more quickly than is possible by any other means, and without noise, and the boards are not damaged in any way, as the holes made by the screws practically close up again when the screws are withdrawn. A small plug of wood may be used with advantage to finish off. The utility of this tool to wiremen in obviating a difficult and untidy job is apparent to those who have had to do without it; its mode of application will also be obvious. The inventor is Mr. W. H. Mott, of 10, Marlborough Road, Old Kent Road, S.E.



The Ajax Floor Lifter.

Book Notices.—*Reinforced Concrete and the Kahn Trussed Bar.*—We have received from the Trussed Concrete Steel Co., Caxton House, S.W., the second edition of their handbook on reinforced concrete, which forms a valuable aid to the engineer engaged in the design and construction of works employing this system. The Kahn trussed bar consists of a steel section with wings, as shown in the figure; the wings are sheared and bent up so as to form stirrups, rigidly connected to the main tension rod, except at the centre, where the web is left intact, so as to provide an additional reinforcement at the point of maximum stress. The

KAHN TRUSSED BAR.

simplicity and convenience of this form of reinforcement are obvious; the concrete is reinforced not only in the horizontal, but also in the vertical, plane, approximately at right angles to the planes of rupture, and the reinforcement is efficiently distributed, while the main member is rigidly attached both to the shear members and to the body of the concrete. The Kahn system has been applied to a great number of structures, of which numerous and varied examples are reproduced in the form of half-tones in the handbook. The latter, however, is not a mere trade pamphlet; it contains a well-written *exposé* of the theory of reinforced concrete work, with curves, diagrams and tables intended to facilitate the process of designing beams, floors, columns &c., in this material. Specifications for reinforced concrete are included, together with tables showing safe loads, and notes on erection. Numerous references are given to other works published by the company on special points. There has been in the past a good deal of vagueness and lack of confidence in the mode of design employed in connection with reinforced concrete, and while many structures have probably been endowed with altogether excessive strength, a few have failed; the guiding principle of sound engineering design, that the maximum strength shall be provided at the minimum cost of material and labour, has not been capable of realisation. We welcome this book, therefore, as a valuable aid towards that ideal.

Fowler's Mechanics' and Machinists' Pocket Book and Diary, 1909. Edited by W. H. Fowler. Manchester: Scientific Publishing Co. Price 6d. net.—This is a new pocket-book, and has been brought out even earlier in the year than the usual crop of pocket-books that we expect by and by. The editor admits that mechanical engineers, draughtsmen and designers are pretty well equipped with cheap and excellent books of reference; but this is intended for the man in the workshop, and may be found of value, not only to the workman, but also to his superiors. Its contents may be guessed pretty accurately: Tables, properties of materials, machine-tool design—a useful and novel section—metal-cutting tools and high-speed steels, shop practice, &c., and they appear to be fully up to the standard of the companion works issued from the same source. Further commendation is unnecessary.

"Institution of Electrical Engineers' List of Members, &c., 1908." London: The Institution.

"Molesworth's Pocket-Book of Engineering Formulæ." Twenty-Sixth edition. London: E. & F. N. Spon. 1908. Price 5s. net.

"Heat for Engineers." By C. R. Darling. London: E. & F. N. Spon, Ltd. 1908. Price 12s. 6d. net.

"Annuaire pour l'An, 1909." Paris: Gauthier-Villars. 1908. Price 1 fr. 50.

"The *Mechanical World* Electrical Pocket-Book, 1909." Manchester: Emmott & Co. 1908. Price 6d. net.

"The Proper Distribution of the Expense Burden." By A. H. Church. London: *Engineering Magazine*. 1908.

"Alternating Currents Simply Explained." By A. W. Marshall. *Model Engineer* series, No. 33. London: P. Marshall & Co. 1908. Price 6d. net.

"Dynamo-Electric Machinery." By C. E. Ashford & E. W. E. Kempson. London: Cambridge University Press. 1908. Price 3s. net.

Catalogues and Lists.—Messrs. Alfred Herbert, Ltd., Coventry.—Sixth edition of their catalogue ("A" section) of horizontal and vertical milling machines. It consists of 118 pages, finely illustrated, and well arranged as usual. Among the various machines included are two new sizes—No. 3 horizontal milling machine, 21 in. × 17 in. × 16 in.—a medium-sized machine possessing the power and rigidity requisite for taking heavy cuts with high-speed steel cutters; and the No. 5 patent vertical drilling machine, 48 in. × 18 in. × 26 in., with single pulley drive. Attachments and accessories occupy a number of pages, and others are devoted to a description of milling machine operations.

Messrs. Johnson & Phillips, Ltd., Charlton, Kent.—Two new price lists just issued. One deals with single and three-phase transformers of air or oil-cooled type. Prices are given for the air-cooled transformers in single-phase up to 50 K.V.A., and in the three-phase up to 75 K.V.A.; and for the oil-cooled transformers, single-phase type, up to 150 K.V.A., and in the three-phase type up to 225 K.V.A. The other list deals with various types of ammeters and voltmeters; prices are given for ammeters and voltmeters of the permanent magnet moving-coil type both in iron cases, and in sector and edgewise patterns, and also in a portable type. Hot-wire ammeters and voltmeters are priced, both in round iron cases and in the portable type. Spring-controlled dead-beat moving iron ammeters and voltmeters are listed, both in iron cases and in sector pattern cases.

Messrs. Heenan & Froude, Ltd., Worcester Engineering Works, Worcester.—Catalogue No. 22, in which the firm give a very fully illustrated description of the Foster patent superheater, of which they are the sole makers outside the U.S.A.

Union Electric Co., Ltd., London, S.E.—List No. 6,020 (sections 1, 2 and 3), in which in the course of some 38 pages are given illustrated descriptions, with diagrams and prices, of Fortiter resistance apparatus.

British Thomson-Houston Co., Ltd., Rugby.—Pamphlets Nos. 211 and 212 in their standard form—the former describing their 1,000-KW. size horizontal shaft type Curtis steam turbine; the latter dealing more fully with the Curtis vertical steam turbines.

The Private Telephone Co., Ltd., 27, Chancery Lane, W.C.—This company has sent us a copy of a new catalogue of private telephone instruments for home, office and factory use, also some popular leaflets relating to telephones for home and business purposes. The company are specially engaged in contracting work for telephone installations, a special point being made of sub-contracting for the telephone portions of electrical contracts. They are at present installing a 40-point automatic intercommunicating telephone service for the General Motor-Cab Co. at their new garage at Kennington.

Messrs. Engineering Instruments, Ltd., 272B, Upper Street, Islington, N.—Leaflet describing, illustrating and pricing their "Direkton" continuous-current automatic motor starter.

Armorduct Manufacturing Co., Ltd., Farringdon Avenue, E.C.—New 12-page price list of "Gral" metallic-filament lamps, which they claim are small and neat, will burn in any position without appreciable sag, and are less fragile than other wire lamps. The "Gral" lamp is listed of 20-C.P. capacity for 100 volts, and of 40-C.P. capacity for 200 volts.

Franco-British Electrical Co., 99A, Charing Cross Road, W.C.—Small booklet relating to their "Franco" patent electric signs.

Messrs. Siemens Bros. & Co., Ltd., London.—An effective show-card, more dignified than sensational, has been issued by this firm drawing attention to its electric batteries for bell and telephone work, motor-car ignition, &c.

Messrs. J. Musgrave & Sons, Ltd., Bolton.—The firm has issued to its friends a handy little vest-pocket stamp and card case, with calendar for 1909, also Mr. Geipel's Engineering Tables, and an insurance policy.

Natal.—Natal Government is going to borrow £500,000 for railway, harbour, telegraph, and other public works.

River Plate.—The Argentine Senate has approved an expenditure of $98,000 for new telegraph lines in the Province of Santa Fe.

Fire.—On Wednesday morning last week a fire broke out at the premises of Mr. Edward Leach, electrical engineer, 27, Church Walks, Llandudno. Considerable damage was done to the goods stored in the basement.

Excursion to Franco-British Exhibition.—Last Saturday week 400 employés of Messrs. Bullers, Ltd., came up from Stoke for an excursion to the Franco-British Exhibition. Mr. J. W. Harris, managing director, and Mr. G. H. Harris, met the party at the Exhibition, where luncheon was served.

Dissolutions and Liquidations.—Mica Boiler Covering Co., Ltd.—Meetings of creditors and contributories are to be held on November 3rd at 11.30 and 12.30 o'clock, at 33, Carey Street, W.C.

Electric Crane Contract.—Messrs. Butters. Bros. and Co., Glasgow, have secured an order for a special heavy electric travelling derrick crane for an English Corporation.

Exhibition Award.—We are informed that the Combination Metallic Packing Co., Ltd., of Gateshead-on-Tyne, have been awarded a Gold Metal and Diploma at a special exhibition in Russia. The firm secured the highest awards at Milan in 1906, and now again at Moscow in 1908.

Foreign Contracts.—Messrs. W. H. Bailey & Co., Ltd., have received a repeat order from the Japanese Government for three tide recorders which are intended to be fixed on the coast of Japan. Each of these recorders will autographically record on a weekly diagram the fluctuations in the tide levels up to 25 ft. The diagram measures 26 in. × 43 in. The diagram drum is driven by a strong eight-day clock movement, fitted with a 12-in. diameter dial. They are also about to deliver an air compressor to deal with 350 cb. ft. of free air per minute for a coal company in India, for working coal-cutting machinery. The firm were awarded three gold medals at the Franco-British Exhibition.

Bankruptcy Proceedings.—Ernest Goacher, electrical engineer and ironmonger, Gateford Road, Worksop.—November 4th is the last day for the receipt of proofs for intended dividend by J. C. Clegg, trustee, Figtree Lane, Sheffield.

The Development of Palestine.—Mr. D. M. Pedrides, writing from Jaffa, Palestine, under date September 27th, 1908, to our contemporary *Engineering*, says:—"I am quite surprised that up till this date nothing has been contributed to your valuable paper concerning the great new era now opening in this country for different engineering works' enterprises. I may point out to

Carbon Lamps.—We understand that in spite of the competition of the wire lamps, the carbon filament is still going strong; the sales of Sunbeam carbon lamps for September last exceeded those of previous years.

your readers that this country is in the infancy of its development, and much capital can be invested with all security with the present Government, which will prove beneficial to the English capitalists and to the development of the country. I may give some hints of such enterprises which may interest some of your readers. Petroleum, carboniferous shales of great commercial value, bitumen, mineral spring waters of excellent qualities, land irrigations of extensive value, electric trams, and machinery, motor-cars, and industrial machinery of every description. Ten years ago a firm started in Jaffa, Palestine, with the name Anglo-Palestine Engineering and Trading Co., with the sole aim to develop the British industry, and it is surprising how much good has been done in this direction. I understand that this same company will be glad to give free any information about different enterprises concerning this country."

Trade Announcements.—Messrs. Hogan & Wardrop, of Gloucester Mansions, Charing Cross Road, London, have appointed Messrs. James Gray & Co., of St. Vincent Street, Glasgow, agents for Scotland for their E.M.I. fans and small motors, and Messrs. John Roberts & Co., of Market Street, Manchester, for the County of Lancashire.

The British Westinghouse Electric and Manufacturing Co., Ltd., announce that Cooper-Hewitt mercury vapour lamps, hitherto manufactured in France and Germany, are now being manufactured in England for sale direct to users and the trade. Inquiries should be addressed as heretofore to the British Westinghouse Co. at Trafford Park, Manchester, or any of their branch offices.

The Manchester branch of the India-Rubber, Gutta Percha, and Telegraph Works, Co., Ltd., is now at 16, John Dalton Street, where a large assorted stock of their various manufactures will be kept.

Messrs. Phillips & Co., of Eindhoven (Holland), announce that Mr. A. J. Bakker, who has been their commercial manager for many years, has been authorised to sign for the firm by procuration.

Storage of Electricity.—The "D.P." Battery Co., Ltd., of Bakewell, send us the following figures as an example of the saving resulting from the installation of one of their batteries after a station had been erected and running some years. The comparison of working has been furnished by the electrical engineer-in-charge. A Diesel oil engine was the motive power, having a guaranteed consumption of ·468 lb. per B.H.P.-hour at three-quarter load. The following figures show the actual working results:—

November, 1906.—10·2 units were generated per gallon *without* battery.

November, 1907.—12·3 units were generated per gallon *with* battery.

Thus the installation of the battery resulted in an increase of 20 per cent. in the output on the same consumption of fuel.

November, 1906...	Total units generated = 24,628	*Without*
	Lb. of oil consumed = 22,718	battery.
November, 1907...	Total units generated = 24,516	*With*
	Lb. of oil consumed = 18,198	battery.

Thus the consumption of fuel was reduced by 24 per cent. on practically the same load. The fuel consumption on the average of four months' working, viz., November to February inclusive, was:—

·580 lb. per B.H.P.-hour *without* battery.
·474 lb. per B.H.P.-hour *with* battery.

The reduction in the average consumption thus shown is 22·15 per cent. In addition to the economy of fuel, the installing of a battery is followed by a reduction in the wages sheet, stores supply, &c., and in the case of a fluctuating load the initial outlay can be considerably reduced by the equalising of the load by means of a battery.

LIGHTING and POWER NOTES.

Aberdeen.—The recently installed 6,600-volt three-phase transmission to the Cults electrical station, was brought into use on Thursday last week. It will be remembered that the T.C. lately acquired the Deeside and district electricity undertaking, which it was agreed should be supplied from the Corporation power station at Ferryhill. Two 100-kw. motor-generators have been installed at the main station, and these supply through static transformers and 50-kw. motor-generators, the Cults network. The Brush Co. supplied the motor-generators, and Messrs. Ferranti the H.T. switchgear, which is of the modern cellular type. The B.I. & H. Co. supplied all the cables; and the cost of the work has been between £6,000 and £7,000.

Acton.—The L.G.B. has informed the Committee that it confirms the decision of the auditor in surcharging two members of the Council who signed the order on the bank for the payment of £10 to the electrical engineer, as an honorarium in respect of extra services rendered at the Electrical Exhibition, but on this occasion the Board exercised its equitable right, and had decided that it was an amount which should be fairly and equitably remitted.

Ashton-under-Lyne.—The B. of G. has sealed an agreement with the T.C. for the supply of electricity for lighting the hospital.

Barnstaple.—By eight votes to two the T.C. has rejected a proposal that "the charge for the supply of electricity for public lighting shall not exceed the rate charged to other large consumers for lighting purposes, and that the Lighting Committee be requested to draw up a system of charges in conformity with this resolution." In committee, a motion to reduce the charge for public lighting from 4½d. to 3½d. per unit was rejected.

Barrow-in-Furness.—The financial result of the electricity works for the year ending March 31st last shows a deficit of £791. This is attributed to an increase of 25 per cent. in the price paid for coal and the increase of £375 in capital charges upon plant, &c., which is only partially employed. The gross profit on the year's working was £5,988, interest on loans £3,240, and contribution to sinking fund £3,539. The electrical engineer, in his report, states that the plant at present installed at the works would be capable, with a comparatively small additional expenditure upon mains, of dealing with an increased demand of 30 per cent., whereas an increase of 10 per cent. in the output at the existing average price would be sufficient to enable the undertaking to meet all charges. The sanction of the L.G.B. has been obtained to the borrowing of a further sum of £5,000 for mains, services, meters, &c.

Belturbet.—The Urban Council has signed an agreement with the Belturbet Lighting Co. for the lighting of the streets by electricity. The company is to supply 50 lamps of 50 c.p. each, with poles, wiring, &c., from September to May each season at £64 per annum.

Birmingham.—At a recent meeting of the Electric Supply Committee, it was reported that the sale of energy for private lighting and power during the September quarter showed an increase of 39 per cent., compared with the corresponding quarter last year, the increase for tramway supply being 7½ per cent. Some 335 motors are on hire, compared with 197 last year at this time.

Clitheroe.—In order to ascertain the probable number of consumers of electricity, the T.C. is having the town canvassed. If the results are satisfactory, plant will be installed at the gas works at an outlay of between £3,000 and £5,000.

Cookstown.—A recent meeting of the Urban Council discussed a letter from Messrs. Miller, Wilson & Pegg, in regard to electric lighting in the town, and it was suggested that a member of the firm should interview the Council.

Droylsden.—The T.C. on Friday passed a resolution to apply to Manchester T.C. urging the Electricity Committee to immediately comply with the terms of the agreement entered into some years ago by which the Manchester authority were to supply electricity in Droylsden.

Dundee.—After comparative tests of electric light and gas at Hilltown, an important district of the city, the Public Lighting Committee recommends that the electric light be adopted.

Glasgow.—The question of substituting metallic-filament for carbon-filament lamps in the lighting of the Municipal Buildings and sanitary chambers, the savings being estimated at £88 and £30 per annum respectively, has been discussed; the former work is to be carried out immediately.

Harrogate.—The T.C. has adopted the scheme for supplying energy to small dwelling houses at a fixed charge of 2s. 9d. per quarter for each 30-watt lamp installed. The maximum number of lamps per house is to be six and the minimum number two; all the rooms fitted are to be adequately lighted by windows during the day-time, and the charges are to be paid quarterly in advance.

London.—The Associated Municipal Electrical Engineers of Greater London have sent a letter to the Metropolitan Borough Councils owning electrical undertakings, calling attention to the serious electrical breakdowns which have recently taken place at the Greenwich power station of the L.C.C. and the Chelsea power station of the Underground Railways, and pointing out that a similar danger would be imminent if the whole of the electricity supply of London for lighting and power purposes were in the hands of either a company or the L.C.C. The Association is of the opinion that London could be most safely supplied with electrical energy by the judicious use and interconnection or linking-up of the existing generating stations, so that a failure of the supply at one point would only affect a small area until such time as the current could be supplied from another station by means of interconnection.

Bermondsey.—A local electrical exhibition is to be held during the second week in February.

City.—At a meeting of the Corporation on October 15th, a recommendation of the Streets Committee that authority be granted it to appoint a deputation to visit certain cities on the Continent for the purpose of inspecting public lighting systems, was discussed. The cost of the visit was not to exceed £200; and the recommendation was approved.

Rawtenstall.—At a meeting of the T.C. on the 16th inst., the town clerk submitted a letter from Messrs. Lacey, Sillar and Leigh, electrical engineers, enclosing draft-book of rates, &c., which were adopted, and it was resolved that consumers pay for the supplying and laying of all mains, &c., inside their own grounds and buildings; and that the prices of electricity be as follows: For lighting purposes, 4d. per unit; for power, 1½d. per unit.

Rochdale.—The Corporation Electricity Committee has arranged terms for supplying energy in bulk to Littleborough U.D.C.

South Africa.—In connection with the recent boiler explosion at the Cape Town Railway Electrical Station, whereby two men were killed, an inquest has been held, resulting in a verdict of accidental death.

Mr. Gearing, of Messrs. Cunningham & Gearing, made a thorough inspection of the boiler—which was of 80 H.P., of the locomotive type, supplied by Messrs. Fowler, of Leeds, in 1902—and reported at the inquest that the firebox crown gave way owing to the corroding away of the stays.

South Shields.—A report recommending that permission be given to the County of Durham Electrical Power Co., to lay three underground cables to the Harton Colliery, the company to pay a rental of £250, came before the T.C. last week, and will be considered at the next meeting of the Council.

Southampton.—The town clerk, borough engineer and borough electrical engineer have been directed to report on the disposal of the old electricity works at Back-of-the-Walls.

Strood.—The Kent Electric Power Co. has reduced the price of electricity for outside arc lamps from 4½d. to 3d. per unit.

Truro.—The T.C. has decided to give Mr. W. Antrobus, of Manchester, every facility for preparing a scheme for electric lighting, without any liability, financial or otherwise, attaching to the Council.

Walsall.—The Finance Committee of the T.C. has recommended that a loan of £4,000 should be raised for extensions of the electrical undertaking.

Yarmouth.—At a recent meeting of the T.C. a report was submitted from the surveyor on the subject of substituting electric light for gas in a working class district of the town. It is at present lighted by 47 gas lamps at a cost of £164, and the surveyor offered to provide a similar number of 50-C.P. electric lamps for £148 per annum. The secretary of the local gas company wrote that such a policy would be injurious to his company's interests, and in no way benefit the ratepayers; the mains were laid chiefly for public lighting, and the company paid £400 a year in rates. The Corporation decided in favour of the electric light.

TRAMWAY and RAILWAY NOTES.

Belfast.—At the weekly meeting of the Tramway and Electrical Committee held on the 19th inst., the arbitration about to be held in connection with the engines supplied by Messrs. Combs, Barbour, of Belfast, in accordance with the Messrs J. G. White & Co.'s contract, was mentioned.

Continental Notes.—GERMANY.—A service of electrical motor cabs is being introduced in the town of Bremen.

GREECE.—Good progress is being made with the conversion of the tramways in Athens to electric traction; two lines are now completed, and are about to be opened for traffic.

Egypt.—A strike of tramway employés has taken place at Cairo, and the service is reported to be at a standstill. The employés demand shorter hours and increased pay.

Hastings.—Recently the Corporation declined to grant the tramway company permission for Sunday running unless the company obtained an Act of Parliament, which should provide that in the event of the Corporation agreeing to purchase the concern no allowance should be made for Sunday profits. At Friday's meeting of the Corporation a letter was read from the company, refusing to go to Parliament for a Bill to "legalise invalid conditions," and stating that under the circumstances the cars would not run on Sundays after November 29th. A proposal to rescind the previous decision of the Council was defeated by one vote only, and a motion that the matter should be considered by a sub-committee was defeated. The feeling in the town is strongly in favour of a Sunday service; on a recent Sunday over 21,000 passengers were carried.

Hythe.—After ascertaining that the tramway company had not approached either Folkestone or Sandgate in regard to its proposal to obain amended Parliamentary powers in Hythe, a special meeting of the General Purposes Committee passed a resolution recommending that the overhead trolley system be adopted, if it is also adopted in Sandgate and Folkestone.

London.—L.C.C.—At the meeting of the L.C.C., on Tuesday, the Highways Committee submitted a report in relation to the proposed reconstruction or construction of further tramways. The report referred to 11 lines, and the total estimates for which approval was sought amounted to £281,265, of which £253,950 was for track work and £27,315 for cables, ducts, overhead equipment, &c. The totel length reached 18¼ miles of single line, which would mostly be arranged on the conduit system, two lines being proposed for joint conduit and overhead systems.

The Highways Committee referred to the decision of July last to obtain expert advice as to the possibility of rendering the G.B. surface contact system installed on the Aldgate-Bow tramways efficient, with due regard to the safety of the public. Mr. W. M. Mordey had been appointed to act for the Council in the matter, and the fee for his services had been agreed at 250 guineas.

It was decided at Tuesday's meeting of the L.C.C. to lend £2,625 to the Woolwich B.C., for mains as to the amount of £1,516, and the remainder for oil-eliminating plant and a motor-alternator.

ISLINGTON.—The B.C., on the recommendation of the Works Committee, has informed the Highways Committee of the L.C.C. that it is unable to consent to the introduction of a Bill into Parliament authorising the construction of tramways in Englefield Road so far as regards that portion within the borough; and reaffirms that Ball's Pond Road should be widened so as to accommodate a double line of tramways, and that such widening should be carried out by the L.C.C. as a metropolitan improvement.

A breakdown occurred on the G.N. and City tube on Monday morning, due to a brake lever on one of the coaches fouling the power rail. Traffic was suspended for over an hour.

An L.C.C. tramcar travelling along Stamford Hill on the 14th inst. caught fire, the plough and electrical equipment beneath the car being considerably damaged. About 20 cars were held up by the accident.

Lowestoft.—A sub-committee is negotiating with a company in connection with the East Anglian Light Railway Order.

The L.G.B. has sanctioned the borrowing of £661 for mechanical stokers.

Manchester.—A special meeting of the City Council was fixed for Wednesday (21st) to adopt resolutions in reference to the promotion of a Bill in Parliament next session to authorise the Corporation to provide and use public conveyances worked on the trolley system without rails; to construct certain tramway lines, including a double line along Moseley Road and Slade Lane, to connect Wilmslow Road with Stockport Road, and to extend the time for completing certain unconstructed tramways, and for the compulsory acquisition of certain lands under the Manchester Corporation Tramways Act, 1904.

On Tuesday a new electric car route was inaugurated from Higher Openshaw and Fairfield to Guide Bridge, which will connect that side of Manchester with Denton, Reddish, Stockport and Gorton.

Pontypridd.—The question of mutual running powers between the Rhondda Tramway Co. and the Corporation tramways was discussed last week at a public meeting, a large majority deciding against the proposal.

Rawtenstall.—The T.C. has received notification of the L.G.B.'s sanction to the borrowing of £33,000 for the provision of an electricity generating station at Hareholme. The Corporation is now committed to an expenditure of £147,000 for tramways.

St. Helens.—Attention is drawn by the elective auditor to the fact that since March 31st, 1903, the sum of £3,392 on the tramways account for the lease of the depôts and the track belonging to the St. Helens Tramway Co., Ltd., had been absorbed, and the account now showed a deficit of £908, in addition to £1,230 paid into it from the highway account. This, he states, is a serious outlook for the ratepayers, as to which there is no apparent prospect held out of any improvement; and the only remedy he can suggest is by making arrangements for securing and working the tramways as a municipal undertaking.

Shawforth.—At a recent Whitworth (Lancs.) D.C. meeting the clerk and solicitor of the Council were authorised to obtain Parliamentary powers for the running of electric tramways between Ending and Shawforth, in accordance with the arrangements already come to between the Council and the Rochdale Corporation. The provisional order asked for will probably be deposited in Parliament early next month.

Southampton.—The sum standing to the credit of depreciation and renewal funds of the Southampton tramways in March last, had increased during the year from £689 14s. to £7,904 10s., while the sum to the credit of the electric light department showed a net increase of £1,911 to £6,805 19s. The auditors consider that these sums should be considerably increased before any allocation in relief of the rates is made.

A London company has applied for permission to provide a service of electric 'buses here, but the Watch Committee recommends that the proposed be not entertained.

Torquay.—According to a Western daily paper, a horse belonging to a coal haulier was electrocuted last week through treading on one of the Dolter tramway studs on Torbay Road, death being instantaneous.

TELEGRAPH and TELEPHONE NOTES.

Glasgow.—The T.C. has received from the Post Office as a contribution in lieu of rates after Whit-Sunday, 1907, in respect of wires, &c., of the telephone undertaking acquired from the Corporation by the Post Office, the sum of £1,000, the proportion falling to the Corporation being £569 17s. 7d., and to the other rating authorities £430 2s. 5d.

Holland.—The telephone system of this country in 1906 comprised 2,671 km. of line and 36,679 of wire, the increases over the previous years being respectively 369 and 11,803 km.; 2,214 km. of line and 29,334 of wire were erected along the railway systems, and the remainder along the main roads; 124 new offices were opened during the year, bringing the total to 306. Inland traffic amounted to 2,161,300 conversations, as against 1,753,274 in 1905, showing an increase of 23 per cent.; 58,600 conversations were with Belgium and 145,741 with Germany, the increases being 18 and 42 per cent. respectively. The joint accounts for the telegraph and telephone services showed that the expenses were £361,829 and receipts £256,981—thus showing that a loss was made for 1906 of £104,848.—*Journal Télégraphique.*

India.—The Secretary of State has approved of the scheme submitted by the Government of India, for the improvement of the pay of the signalling establishment of the Indian Telegraph Department. The initial pay of the general service will be Rs. 50, rising by annual increments to a maximum of Rs. 200, ordinarily attainable in the 20th year. In the case of the local service the minimum pay will be Rs. 35, and the maximum Rs. 130, which may be reached in the 22nd year. After 14 years' service a signaller will be expected to pass the efficiency bar. No signaller who fails to pass can rise above the pay which he is then drawing—Rs. 140 in the case of the general scale, and Rs. 90 in the case of the local scale. The pay of the telegraph masters, general scale, will be Rs. 200, rising to Rs. 250 in the case of the general service, and Rs. 130, rising to Rs. 180 in the case of the local service. Above the telegraph masters will be two classes of deputy superintendents, of whom the lower class will correspond to the officers known as telegraph masters, first grade, and the higher class to sub-assistant superintendents (traffic). The pay of the lower class will be Rs. 250, rising to Rs. 325, and of the higher class Rs. 325, rising to Rs. 400. A limited number of the higher class will, however, be permitted to rise to the higher maximum of Rs. 500. The cost of the new scale of pay exceeds the cost of the old scale by about 5½ lacs of rupees.—*Bombay Gazette.*

Thefts of Wire.—Since August last, says the *Daily Telegraph*, 4,000 yards of copper telegraph wire have been stolen from the Midland Railway within two and a half miles of Walsall, and 700 yards of the London and North-Western wire. Six detectives have been in the district, and on Sunday night they caught two men red-handed.

Telegraphic Interruptions and Repairs:—

Cables.	Interrupted.	Repaired.
Port Arthur-Chifu	Mar. 9, 1904 ..	..
Assab-Massouah	June 28, 1908 ..	..

Telephone Employés.—The dismissal of employés by the National Telephone Co. continues to attract attention. In the House of Commons on Monday last, in reply to questions, Mr. Buxton said that a considerable amount of underground wire had been laid by the Post Office since 1905 and leased to the company; this policy, which was being pursued as actively as possible, would to some extent meet the difficulty, and he was discussing with the company what further arrangements could be made, to avoid interruption of the work of construction.

A special arrangement for the proper development of the telephone system in the Glasgow area by the company and the Post Office in co-operation had been nearly completed. The company stated that the discharges which had so far taken place had been mainly caused by a falling-off in orders, due to the recent depression of business throughout the United Kingdom. Competent workmen discharged by the company would be taken into the Post Office service when possible.

The Central Committee of the National Telephone Staff Transfer Association states that in the course of a few months the company's construction staff, numbering about 6,000, will be paid off. The amount of wages lost to these men between now and the end of 1911 is set down at about £5,000,000. The result will be, it is stated, that all the arrears of the work will have to be accomplished in 1912 with a vastly augmented staff, at a considerably greater proportionate cost to the State and grave inconvenience to subscribers, which could be prevented if a joint purse arrangement were come to between the Post Office and the company whereby the constructive work could be continued.

Wireless Telegraphy.—The General Post Office Circular gives notice of new arrangements which came into force last week. In most cases the Marconi Co.'s Sailing Lists will remain the standard source of information with regard to communication with ships through coast stations in the United Kingdom. In future the charge for telegrams intended for transmission to the ships named in those Lists, through the coast stations mentioned therein, will be at the inclusive rate of 10½d. per word, without any minimum. When a message is handed in at such a time as will not permit of its reaching the coast station to which it is addressed within the hours specified in the Lists, it should be accepted at sender's risk only; but if the ship is known to have passed out of range, and no attempt is made by the coast station to transmit the message, the charge (less the ordinary inland rate) will in future be refunded on application. Messages to the Midland Railway Co.'s packet *Londonderry* between Heysham and Belfast are charged at the inclusive rate of 1d. per word with a minimum of 1s. per message.

The Parkeston Quay Wireless Station communicates with the *Amsterdam*, *Copenhagen*, and *Vienna* of the Great Eastern Railway Co. Messages are chargeable at the rate of 2d. per word, with a minimum of 1s. 8d. per message for the radiotelegraphic transmission, plus the ordinary inland telegraph rate of ½d. per word with a minimum of 6d. per message. Then, again, the following vessels can be reached by the Marconi Co.'s system, but messages can only be accepted at sender's risk, as their times of arrival and departure are uncertain. To the *Bremen*, *Cap Arcona*, *Cap Blanco*, *Cap Frio*, *Cap Ortegal*, *Cap Roca*, *Cap Verde* and *Cap Vilano*, for a message of 10 words or under a fixed charge of 4s. plus 6d. per word. For a message of more than 10 words 10½d. per word. To the *Esthonic* and *Rossia* 10d. per word plus the ordinary inland rate. To the *Konig Friedrich August*, *Konig Wilhelm II* and *Metcor*, for a message of 10 words a fixed charge of 4s. plus 6d. per word; if over 10 words 10½d. per word.

It is announced from New York that Mr. W. J. Willenborg has invented a system of wireless telegraphy, the great virtue of which is claimed to be the impossibility of tapping it.

CONTRACTS OPEN and CLOSED.

OPEN.

Atherton.—October 28th. Three 50-KW. single transformers for the U.D.C. See "Official Notices" to-day.

Australia.—ADELAIDE.—November 20th. The City Council requires tenders for the supply and erection, complete, of a refuse destructor, electric lighting plant for the same, &c. Particulars may be obtained from the Agent-General for South Australia, 1, Crosby Square, Bishopsgate Street Within, E.C.

TASMANIA.—March 15th, 1909. Postmaster-General. Telephone switchboard, common-battery system and apparatus for use at subscribers' premises, Launceston. Specifications and particulars of general conditions can be inspected at the offices of the ELECTRICAL REVIEW.

TASMANIA.—November 2nd. Telegraph material, including four miles and five miles respectively of paper-insulated telephone cable, and 10,000 yd. of webbing for the Postmaster-General, Hobart. Specifications may be seen at the offices of the ELECTRICAL REVIEW.

VICTORIA.—Three sets of testing instruments, for the P.M.G. See "Official Notices" October 16th.

Belgium.—November 11th. Tenders are required by the Direction of the Belgian State Railways for an electric signalling cabin complete at the Nord Station. Particulars No. 260, 1908, are obtainable from Mr. de Rudder, 11, Rue de Louvain, Brussels.

Bury.—October 23rd. Electric lighting of the East Ward Council School for the Corporation. See "Official Notices" October 9th.

Epsom.—October 23rd. Storage battery for the U.D.C. See "Official Notices" October 16th.

Germany.—The municipal authorities of the town of Budingen (Hesse) are about to invite tenders for the establishment of a central electric lighting station in the town, at an estimated cost of £12,000.

KOLBERG.—The authorities of this city are about to invite tenders for various electrical installations, including underground transmission system, 910,000 marks; other electric works, 460,000 marks.

BIELINGEN (BADEN).—Tenders are invited by the Communal Council for the establishment of an electric installation.

KIRCHBARKAU (HOLSTEIN).—The communal authorities are about to invite tenders for the erection of a public electric system to serve the town and 10 adjoining villages.

BREMEN.—Tenders will shortly be invited for the works and material needed for the projected extension of the existing electric service.

November 2nd. Tenders are required for the supply, installation, &c., of an electric passenger lift at the municipal hospital, Spandau. Particulars may be obtained at the Stadthaus, 14, Potsdamerstrasse, Room 31.

G.W. Railway.—November 10th. Stores for the G.W. Railway. See "Official Notices" October 2nd.

Hungary.—The municipal authorities of Monor are about to invite tenders for the establishment of a central electric lighting station in the town.

Leigh.—November 7th. Steam slack for the B.C. electricity department. See "Official Notices" to-day.

(*Continued on page* 711.)

SUPPLEMENT.

ELECTRIC WIRING AND FITTING.

By C. C. METCALFE, A.M.I.E.E.

In few branches of electrical engineering has there been a greater change during the last few years than in that relating to the erection and installation of lamps, motors, &c. Indeed, so keen has been the interest aroused in the trade with the advent of each improvement, that it is difficult to say anything that has not been said many times over in the past. The battles of casing *v.* conduit, conduit *v.* lead-covered, &c., have been fought, and re-fought, times without number in the electrical Press, and victories won by the advocates of each system (at least to their own satisfaction).

It seems, however, not so much the question as to which is the best system that should interest the contractor of to-day, as "Which system or grouping of systems is the most applicable to the installation he has in hand?" For if the contractor would make a success of the work he undertakes, he must not be a "casing," "conduit" or other "system" man, but must be well acquainted with the advantages and disadvantages of them all, and be prepared to take advantage of the good points of each. A certain fashion seems to have sprung up lately entailing the use of conduit for each and every installation, quite regardless of its suitability. The higher pressures employed during the last few years are probably responsible for this, for unless conduit is installed in a building during its erection, it rarely lends itself so readily to the work in hand as do some of the other available systems. Nothing could well be worse in the true interest of the industry than that fashions such as this should be generally followed.

Every installation should be dealt with upon its own merits with a view to its special requirements, for rarely are two installations alike, and while the employment throughout of either casing, conduit, lead-covered (single or twin) conductors, flexible, cleated, or on insulators, &c., may sometimes be desirable, on a large installation it is rarely conducive to the best results to employ one system only. A much better and more satisfactory result is obtained by the judicious use of two or three of the above. One of the standing objections to the use of casing is that it is not damp-proof, and to conduit that it allows of condensation; it is quite true that occasionally moisture does give trouble, but the great majority of faults in installation work are not due to this cause. The bulk of engineers will agree that most installation troubles are due either to faults on flexibles or to the conductors coming in contact with their metal sheathing, either conduit, or lead-covering.

All the various wiring systems have their inherent good and bad points, but all systems are dependent for their success more than anything else upon good workmanship, bad and careless workmanship having ruined more electrical installations than all other causes put together. Any improvement in wiremen and their methods of working will do more to promote the success of the wiring industry than the introduction of any new systems, however efficient they may be. The wireman of to-day is, in many respects, little better than the wireman of 20 years ago, impossible as that may seem, and it is to be hoped that in the near future some system of registration, based if possible upon examination, will ensure that the workman employed shall be a craftsman; then, and then only, shall we see any considerable improvement in wiring methods. It is unfortunately at present only too common to see workmen hammering screws into capping, pulling by main force conductors into conduit, scraping insulation (including half the copper strands) off flexible and leaving bunches of cotton trailing into fittings, not to mention hosts of other examples of careless workmanship, and any system that will eliminate such men from the ranks of the trade will be welcomed by all good workmen.

Whether it is due to the rush that becomes necessary on low-priced installations or to sheer indifference on the part of the men themselves it is difficult to say, but carelessness in detail (and all good work depends on detail) characterises the great bulk of the wireman's methods to-day.

The writer comes into very intimate contact with many wiremen and apprentices each winter in connection with the classes for such men, probably in much closer contact than it is possible for the masters to do, and it is very discouraging to see the shiftless methods adopted by the majority in jointing and connecting up fittings, &c., and also the lack of general electrical knowledge exhibited by them. Of course, it may be argued that only those attend classes who do not know; that is to some extent true, but careful questioning as to why such and such a method is adopted invariably brings the answer, "That's how we do it at our shop," or "That's how our men do it." Everything appears to be carried out in a slipshod and hurried manner, and few men seem to take sufficient interest or pride in good work. Their main object seems to be to finish quickly; not in such a manner that the work shall last and be a credit to them in years to come, but so that they may get away to another job as quickly as possible. Such methods are surely neither to their own nor to their employer's interest or advantage, for badly finished-off installations are a constant source of trouble to the customer, and are frequently the cause of the "non-adoption" of electricity, for who has not heard of the "customer who may be," who says, "No, I cannot think of adopting electricity; it is so unreliable," or "it is too expensive"? His opinion is formed most probably from experiences of his friends' installations, where careless (not necessarily bad) workmanship has caused considerable trouble and minor breakdowns. Another cause of trouble is a want of forethought and care in planning and setting out the installations in the first instance. Many firms regularly send workmen out to undertake and carry out installations involving the expenditure of hundreds of pounds, with no further particulars than those embodied in a schedule of lamp positions and switches. This is surely not a system that tends to good and lasting work, and it is difficult to point to any other trade that adopts similar methods.

Standardisation in appliances and fittings would no doubt

largely overcome many faults of erection, for if things were more interchangeable much of the erection could be simplified, greatly to the advantage of all concerned. Surely in the majority of cases this is not impossible?

If, however, it cannot be arrived at, there is nothing to prevent each firm from standardising its own methods of work, and, within limits, the materials that are in regular use. For example, main switches and fuses might always be mounted a certain distance from the wall, the mains entering, say, the lower terminals of the fuses, and thence through the switches, either at the bottom or the right-hand side, according to the type of switch employed. Again, the positive lead might always be the right hand or top one, the negative the left or bottom. In all switches, fuses, distribution boards, &c., rules of this character could readily be carried out. Distribution boards should be fixed at a regulation height, say, 7 ft. 6 in. from the floor; this would readily allow of fuses being replaced off a chair or stool. Circuits as they leave the board (reading from left to right) should control groups of lamps in the same order so far as circumstances will allow. If two colours of conductors are in regular use, let the red be always positive, and the black negative. Let the left-hand or bottom terminal of all small switches be connected to the switch feed. Let all single-pole switches be on one pole, that is to say, let them always be on one colour of conductor. When employing two-way switches, always lay wires of a different colour for the strapping wires. All wires in conduit should be drawn in, *after* the conduit is fixed in position. Conductors should not be "pulled off" coils, but should in every case be unrolled in such a manner that it is impossible for kinks to form. A small printed slip could readily be provided for each workman embodying these and such other rules and methods as the contractors may consider desirable, and a rigid adherence to them should be enforced. Such a system as is briefly outlined above will soon bring its own reward in the ease and rapidity with which faults can be remedied and tests and extensions be made; and, in addition, better workmanship is sure to result, for it would allow of quicker and more thorough inspection.

It is almost certain that the next few years will, owing to the introduction of the metallic-filament lamp, see a great change in the methods employed for lighting. Either auto-transformers converting the pressure to, say, 25 volts, will be employed, thus allowing the use of a range of light units, as at present, or the higher-pressure lamps will be perfected, allowing of the use of 8 c.p. and upwards on the normal pressures at present available. The former system, with a pressure of, say, 25 volts on the circuit, will probably become the most popular, and with such a pressure the present systems can, and will, be considerably modified. A much cheaper insulation can be used on the conductors. Probably the conductors can be laid under floors and in roofs, simply spaced apart and held in position with hardwood cleats or insulators, casing or conduit being used only where the conductors come into view. Porcelain base fittings, ceiling roses, switches, &c., of the cheaper varieties will be relatively of higher insulation value than the best qualities in use at present. Errors of workmanship will not then be so fatal to good results as they now are on the higher pressures, and in many other ways the cost of wiring will be considerably cheapened.

Many contractors do not seem to realise that heaters, kettles, radiators, &c., are really practical appliances, and in fitting up installations it would certainly be wise to make more liberal wall-plug arrangements than is at present usually the case, with a view to their more ready adoption, for there is no likelihood that anyone having once tested the practicability of electrical appliances, as above suggested, will ever after find his requirements met by any other.

Finally, there are many tradesmen, plumbers, ironmongers, gas fitters, &c., who, in a more or less scrappy way, are "taking up" electric wiring, not always to the benefit of the industry. "A little knowledge is a dangerous thing," and it behoves the electrical contractor who would keep to himself the trade that is legitimately his, to bestir himself and keep well abreast of the times.

ELECTRIC SIGNS.

In spite of the frequent and vigorous advocacy of the electric sign in these and other columns, the electrical engineer is not as yet thoroughly prepared to run after a sign order. It is not yet fully realised that, on our big buildings commanding street vistas, in our public thoroughfares, on railway and other bridges, and along the immense line of our river banks, there are opportunities for advertising display that even this conservative nation cannot afford to neglect.

It is therefore refreshing to read in the *Western Electrician* a brief summary of what has actually been done in New York City. In proceeding to indicate the points enumerated by Mr. W. F. Turnbull, the writer, let us clear away the idea that American cities are any less hampered by stringent restrictions than our own. In New York City, roof signs must not exceed a height of 9 ft. above the highest part of the cornice, unless built on two frames one behind the other, in which case the rear frame may have a total height of 18 ft. Wall signs must not project more than 1 ft. from the wall nor obstruct any openings, such as windows. All signs must be constructed of fireproof material. Signs standing at right angles to buildings must not project more than six feet nor have any point less than 10 feet above the footway. A full description in triplicate of the proposed sign and work in connection therewith, including cost, must be filed with the city clerk by the prospective owner of the sign. A certificate has then to be obtained from the Department of Buildings, that the construction of the building has been inspected and found in accordance with the legal specifications. The sign may then be built, but no current can be turned on without proper certificates from the Board of Fire Underwriters and the Department of Water Supply, Gas and Electricity as to the character of wiring and fittings. And, finally, for signs projecting over the footpath an annual licence fee of ten cents per square foot has to be paid.

These are the difficulties, and they reflect the sort of thing that has made engineers in this country so pessimistic about ever getting a large sign scheme past a town council. Now let us see what New York has done with its sign problem. Firstly, there is the "Great White Way,"—a continuous blaze of white light signs on stores and theatres on Broadway between Twenty-third and Sixty-sixth Street. Better still, there is the tremendous display on the water front that greets the incoming visitor on an Atlantic liner. The amusement parks at Coney Island; the illuminated tower of the 40-storey Singer building which can be seen several miles at sea; the Butterick sign with an initial letter 68 ft. high, and all other letters 35 ft. high; the sign measuring 50 ft. by 200 ft. belonging to Colgate & Co., the soap people, having, besides lettering, a mammoth electrically outlined clock; the "Pearline" roof signs, one 200 ft. long and the other 150 ft. long, with letters 25 ft. high; the Heinz pickles sign, the Anheuser-Busch Brewing Co.'s sign, and many others, produce a dazzling effect which is one of the sights of the world. The railroad companies, such as the Lackawanna, Erie and Pennsylvania, mount huge signs on their station roofs; the shipping companies use the same means of advertisement; real-estate development is assisted by electric signs, one being 200 ft. long and 20 ft. high; the New York Edison Co. has itself a huge changing sign announcing in succession the names of a number of new buildings that use the company's supply. Beyond this, the number of small signs on buildings and over shop doors is simply legion.

The reply to all which will probably be, that America is not England. But why, in the name of all that is practical and paying, can we not have a few really big signs here?

POWER PLANT EXHIBITS.

[Descriptions of further Exhibits of Steam and Electrical Power Plant are given below.]

British Thomson-Houston Co., Ltd. (48, 49, 50).

The most prominent feature of the B.T.-H. Co.'s stand is, of course, the horizontal-shaft Curtis turbo-generator, giving 1,000 KW. at 3,000 R.P.M. This is a new pattern now being introduced by the company; the mode of action and system of governing are practically the same as those we are familiar with in the vertical type, and need not be described.

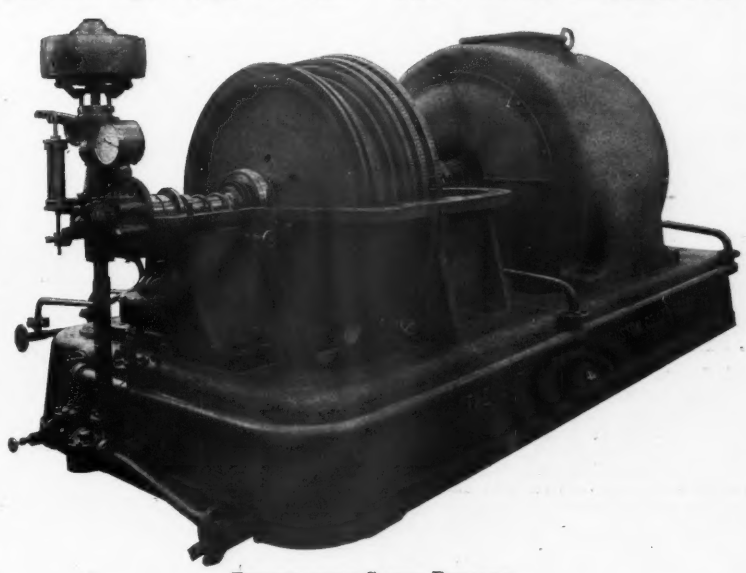
The turbine exhibited is coupled to a two-pole 50-cycle alternator with direct-connected exciter, and is designed for superheated steam at 150 lb. pressure, with condenser. The turbine casing is of cast-iron, divided on the horizontal plane through the shaft; the latter and the bucket wheels are of high-grade steel, and the shaft is very short, owing to the small number of stages employed, so that there is no tendency for the shaft to whip.

The bearings are spherically seated and lined with Babbitt metal, and are lubricated under pressure by a small rotary pump driven through worm gear from the main shaft; oil rings are also provided, to lubricate the bearings while starting up, and to assist the normal distribution of the oil in the bearings.

Horizontal Curtis Turbo-Generator.

Besides the centrifugal governor, which maintains the speed constant within 2 per cent. from no load to full load, an ingenious and simple form of emergency governor is fitted, which shuts off the steam if the turbine attains a speed 15 per cent. above the normal.

The rotor of the alternator is of novel construction, designed to have good ventilation, together with ample strength to withstand the stresses due to centrifugal force, without the use of fans, wedges, or other detachable parts, so as to provide a sound mechanical structure capable of exact and permanent balance. The winding of the rotor is arranged for standard exciting voltages, thus avoiding difficulties due to the use of low voltages and large exciting currents. The alternator is designed for close regulation of the voltage, and has a rated capacity of 1,250 K.V.A., with an overload capacity of 25 per cent. for two hours.



Turbine with Casing Removed.

The whole set is manufactured complete at Rugby, and is remarkable for its compact design, the turbine portion being very short. The accompanying illustrations show it from the governor end, complete, and with the upper half of the casing removed, showing the rotor of the turbine.

Besides the turbo-generator, a ring spinning frame driven by a British Thomson-Houston induction motor, and a variety of apparatus manufactured by the company, including arc lamps, heating and cooking apparatus, &c., are shown on the stand; these exhibits will be dealt with in other sections.

James Proctor, Ltd. (118).

The firm are exhibiting their patent shovel and coking stokers and coal elevator. The shovel stoker has been extensively adopted for electric lighting stations, as it is a system of firing well adapted to meet the varying demands of steam at this class of works; the method of sprinkling the coal upon the fires in small quantities enables the fires to be pushed to an almost unlimited extent, so that it is possible for the maximum duty to be obtained from the boilers.

The coking type of stoker is more adapted for boilers on which the load is constant, and where the demands for steam are not heavy. It is a smokeless system of firing, giving excellent economical results, and Messrs. Proctor's method of delivering the coal to the fires possesses important advantages. The coking is done inside the furnace—in fact, upon the bed of incandescent fuel — thus preventing injury to the boiler front. The fires are easily accessible, and firing by hand can readily be resorted to if required.

With regard to the coal elevator, it is a well-known fact that a fruitful cause of failure in coal-handling plants is due to the wear and tear, and constant breaking of the chain and buckets, on account of there not being a positive supply of fuel to the buckets, in consequence of which the elevator boot becomes filled with coal through which the buckets have to be dragged, thereby putting a great amount of friction and strain upon the whole elevator. This is entirely obviated by Messrs. Proctor's ram feed arrangement of the elevator boot. The coal is pushed by means of a ram into the elevator buckets in small and regular quantities, thus preventing friction or jamming, and consequently the elevator works with a minimum of power, wear and tear, and cost of upkeep.

A. G. Thornton, Ltd. (222).

In addition to a large display of drawing and surveying instruments, for which they are so well known, the firm are making a special feature at their stand of the Shaw continuous rotary copier for reproducing photo-prints. They also show the "Pelham" drawing apparatus, which is so adapted that the worker has full command of the board for either sitting or standing, without necessitating any bending of the body or contraction of the chest. It can be easily regulated to any convenient height, and instantly adjusted to any angle. The "Leoham" attachment, by which the draughtsman is enabled to keep the stock of the tee square firm and true to the edge of the drawing board during the process of drawing, is exhibited, as also is a variety of sectional papers and cloths.

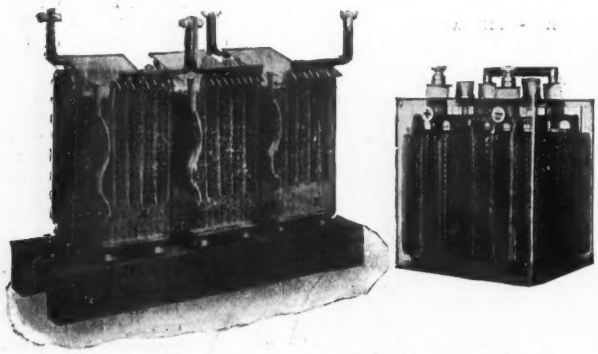
The Electrical Power Storage Co., Ltd. (128).

The well-known E.P.S. Co. exhibit a variety of their stationary and portable cells, and small accessories. The foremost place is occupied by heavy types suitable for power station work. The "OL" type is the largest plate at present made by the company; each positive plate weighs 48 lb., and can give 165 amperes for half-an-hour or 115 amperes for one hour. The "OK" type, which is also shown, is slightly smaller, the

E.P.S. "OK" Cells.

positive plate weighing 40 lb. and giving 140 amperes for half-an-hour or 100 amperes for one hour. The accompanying figure shows complete cells of this type in lead-alloy crates. The "P" type plate, which can be supplied in glass boxes, gives 55 amperes for one hour, for a weight of 22 lb. Either Planté or pasted positives are supplied, according to the purpose for which the cells are to be used. The "DH" and "SH" types are lighter models, in which the plates are suspended from the sides of glass boxes, as shown in the figure below.

Quite a different class of cell is the E.P.S. "Moting" type, which has been developed for automobile propulsion, and gives 11 watt-hours per pound of cell. These cells are made up in ebonite boxes, and with a set of them weighing 8 cwt., a carriage can be driven 50 miles; formerly it would have required nearly three times this weight to do the same work. "EPSCO" motor-car ignition cells



E.P.S. "DH" Cells. "EPSCO" Ignition Cells.

in polished wood boxes, or in celluloid, as illustrated herewith, are made in several varieties; portable batteries and various accessories are also exhibited, while the stand is lighted with 25-volt metallic-filament lamps, from a battery of 14 "DH" cells, having a capacity of 840 ampere-hours.

C. A. Parsons & Co. (154).

Messrs. C. A. Parsons & Co. are exhibiting four scale models of some of their well-known turbine plants. These models are all made to the uniform scale of 1 in. to the foot, and represent:—

1. A turbo-alternator capable of giving an output of 2,000 kw. normal rating, and an emergency output of 4,000 kw.
2. Turbo-alternator, 3,500 kw. normal, 7,000 kw. emergency.
3. Turbo-alternator, 7,500 kw. normal, 14,000 kw. emergency.

The turbo-alternators are generally of the type fitted in the Carville power station of the Newcastle-upon-Tyne Electric Supply Co., Ltd., and many other generating stations. The turbines are of the single-ended type, with dummy pistons to balance the end pressure, and a plant similar to model No. 2 had the extremely low steam consumption of 13·189 lb. per kw. at 190 lb. steam pressure superheated to 120° F., and with a vacuum of 29·039 in. (bar. 30 in.) at cylinder exhaust.

The revolving-field alternators are of Messrs. Parsons's well-known type, with salient pole rotors and tunnel-wound stator windings. The sets shown, being of large size, have alternators arranged to be divided along the horizontal line, giving easy access to the rotor and all windings.

The fourth model represents a Parsons turbo-blowing engine specially arranged for the utilisation of exhaust steam at atmospheric pressure. The machine represented by this model is capable of inhaling 20,000 cb. ft. of free air per minute and discharging it at 10 lb. per sq. in. pressure when running at its normal speed of 3,000 r.p.m. Arrangements are provided, by means of an adjustable governor and by-pass valves, to enable the speed of the engine to be raised from 3,000 to a maximum speed of 3,600 r.p.m., so that a pressure of 20 lb. per sq. in. can be easily obtained, should such exceptional pressure be required for the purpose of blowing down any scaffolding that may occur in the blast furnace.

The steam turbine, which furnishes the motive power of this plant, is made on the double-ended principle, steam being admitted at the centre of the turbine and exhausting towards both ends, the exhaust steam passing through to the condenser by two outlets on the cylinder bottom.

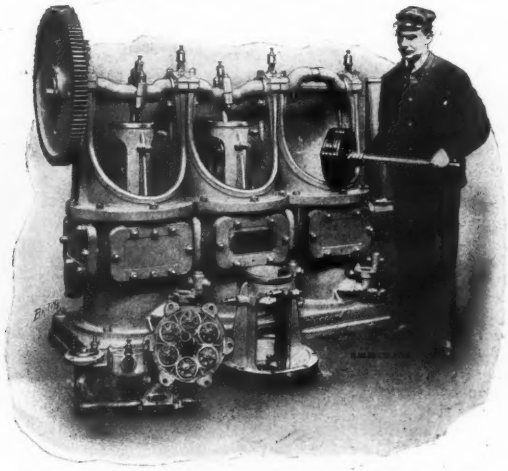
The blowing engine is of the Parsons standard type, and is an exact model of the very large number of these sets which have been supplied to various iron, copper, and other smelting works, both in this country and abroad.

In front of this model are placed scale models in steel of the steam and air shafts respectively, the object being to show the stiffness of construction used in Parsons's form of blowing engine. The steam shaft, owing to the turbine being double-ended, has no dummy pistons. The shafts are grooved ready for the fixing of the blades in the usual way.

The Mirrlees Watson Co., Ltd. (244a).

The Mirrlees Watson Co. exhibit one of their "Mirrlees-Edwards" type of three-throw air pumps. The pumps shown have working pistons 15 in. diameter × 8 in. stroke, and are driven by means of an electric motor through single-reduction gearing.

One of the features worthy the attention of visitors is the complete accessibilty of these pumps for the inspection of internal parts. By simply disconnecting the connecting rods and loosening the pump cover bolts, without disturbing the crankshaft or a single bearing, the pump buckets, the rods, the pump covers, and cross-head guides, can be removed in a very short space of time; in fact, the whole of the internal parts of one pump can be removed and replaced, and the pump ready for running again, in a little over half-an-hour from the shutting down of the pumps from duty. This feature of accessibility is demonstrated by the attendant at the stand. Also the pumps exhibited are connected with a closed receiver, so that their vacuum-producing quality can be demonstrated, a small amount of water being circulated for the purpose of water-sealing the buckets, and the barrels. The results show that a remarkably high vacuum is obtainable with these pumps.



"Mirrlees-Edwards" Air-Pump—13 Minutes from Shutting Down.

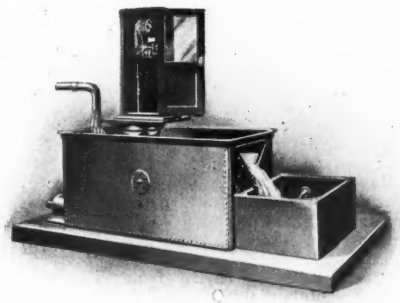
A further feature is the substantial design of the bearing frames and bearings, and in all sizes of pumps the Mirrlees Watson Co. adopt the practice of forming the pump bodies of quite separate castings, and not arranging two or three pump bodies in one casting. This not only avoids the cracking of air pump castings, but also tends towards greater accuracy and inconvenience, the separate pump bodies and other parts being made accurately to gauge. The pump body, the delivery plate, the crosshead guides and the frames are all prepared with turned and bored registers, thus securing a perfect alignment of the various parts. The design is somewhat more expensive than the ordinary pattern.

The National Gas Engine Co., Ltd. (27).

This firm is exhibiting one of its new model "YE" type engines, which is fitted with the latest improvements in the way of ring lubrication on the main bearings, throttle governing, electric ignition, and compressed-air starting. The engine will be supplied with gas by one of the same company's "Gold Medal" type suction gas plants, the name of the latter being due to the fact that this type of plant received the highest award at the recent trials of suction gas producers held by the Royal Agricultural Society at Derby. The company is also showing a combined electric lighting set, consisting of the "ME" type engine running on town gas, and driving a dynamo through a coupling.

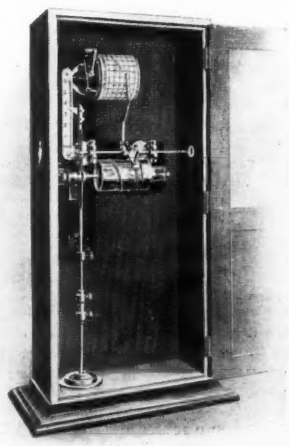
Jas. E. Lea (179).

Mr. Lea's exhibit consists of his patent water recorder, which, by registering the variations in the rate of flow of water over a weir or notch, provides a record of the total volume which has passed



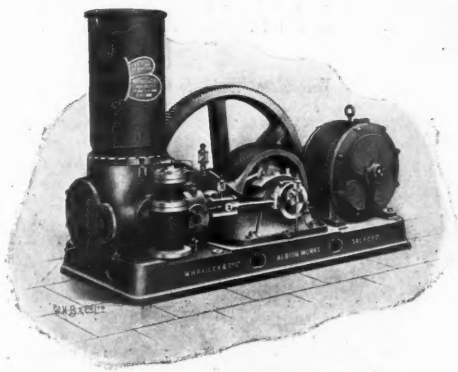
Lea's Patent Water Recorder.

during any given period. The law connecting the rate of flow with the depth of water over the notch is far from linear, but Mr. Lea introduces between the float and the recording pen a device by



Interior of Lea Recording Device.

means of which the motion of the latter is made directly proportional to the rate of flow, so that the area of the diagram obtained upon the chart of a clockwork recording drum is a

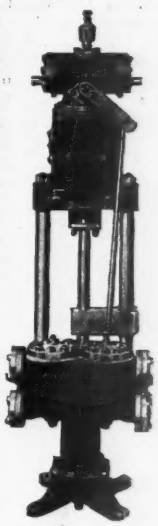


Bailey's Two-Stage Compressor.

measure of the total quantity, which is deduced with the aid of a planimeter. The ingenious device above-mentioned consists of a cylindrical cam, the contour of which corresponds to the curve relating rate of flow to depth. The apparatus is suitable for measuring boiler feed, condenser discharge, circulating water, &c.; it is, therefore, useful not only for consumption tests, but also for keeping a continuous record of the running of power generating plant, and a very high degree of accuracy (over 98 per cent.) is claimed. Installations of this recorder are in use at many British electricity works, including the Manchester, Edinburgh, Leeds and other municipal stations. The accompanying figures show a complete plant for measuring 10,000 gallons per hour, and the interior of the 6-in. recorder, showing the cylindrical cam.

W. H. Bailey & Co., Ltd. (215).

This firm are showing among a number of their specialities two or three types of "Köster's" patent air compressor, which has a mechanically-operated piston valve for admitting air to the cylinders and only one outlet valve, the action of which is controlled by the piston valve, so that it is allowed to open wide and to seat itself noiselessly. Opening wide, it can be made small in diameter, leaving the whole of the cover of the cylinders and a great part of the cylinder jacket available for cooling. The "Köster" patent valve gear enables the compressor to be run at high speeds, thus it is particularly suitable for being driven by the most economical type of steam or gas engine or by electric motor. One of the compressors shown is suitable for running at a speed of 1,000 R.P.M., and can be directly connected to an electric motor. It deals with about 12 cb. ft. of free air per minute, compressing it to 90 lb. per sq. in. This could be used for a variety of purposes, such as cleaning dynamo and motor parts, supplying air for blowing whistles or sirens, operating compressed air-brakes, &c.

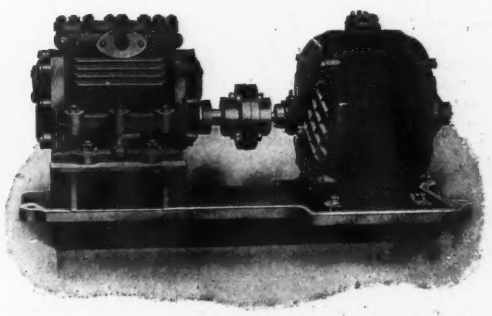


"Davidson" Vertical Steam Pump.

Another compressor is shown working coupled direct to an electric motor, and running at a speed of 600 R.P.M. This machine will deal with 7½ cb. ft. of free air per minute, and compress it to 180 lb. per sq. in. It is a two-stage single-cylinder machine. It is very suitable for arrangement as a portable plant, and can be used for a variety of purposes, including the starting of large gas engines.

The "key-ring" renewable valve seat which is fitted in stop valves for high pressure superheated steam, is also shown. It allows for differences of expansion between the seat and the body, and can be easily removed and replaced. The principle of the "key-ring" is the adoption of a flexible metallic connection between the seat and the body, similar in construction to the well-known Ramsbottom piston ring. The seat of the ordinary type is screwed into a spring ring, which is sprung into a groove in the valve body. The seat can be removed and replaced with ease, and it will expand freely in all directions and remain tight under all pressures and temperatures.

The "Foster" reducing valve is a spring-controlled valve which will open from any degree to full bore, according to the demand



Bailey's XI Compressor.

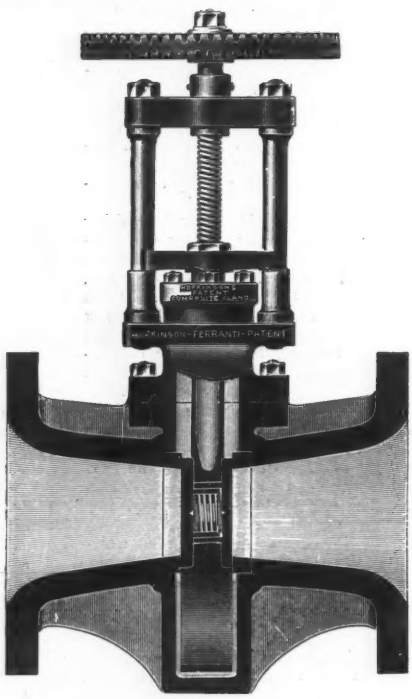
made upon it. This is accomplished by means of its differential spring arrangement, which maintains a constant pressure on the governing diaphragm, irrespective of the degree of compression of the spring.

There are also two types of the Bailey "Davidson" patent steam pumps for boiler feeding. One is shown working at a very slow speed, and fully demonstrating what the makers claim for the pump, which is, that it can be run at any speed from two or three strokes per minute upwards. The pump is driven by means of compressed air delivered by the small air compressing plant already referred to.

The two pumps shown are of the vertical type, similar to those fitted on many battleships. The firm also make horizontal pumps with rams or pistons with the same valve gear. Another speciality is the recording gyrometer or sight-speed recorder. This instrument records on a 24 hours' diagram the speed in revolutions at which an engine or shaft is running. It gives a legible diagram, as the speeds and times are indicated by straight lines. It is fitted in an enamelled metal case, and is really a modification of the firm's well-known gyrometer or tachometer, used by the Admiralty and many electrical engineers. A steam-pressure recorder is also shown, as well as a large number of different patterns of engine and boiler fittings, including valves, pressure and vacuum gauges, injectors, lubricators, &c.

J. Hopkinson & Co., Ltd. (93).

The company are showing a full-sized model boiler fitted with their patent boiler mountings, as well as various pipes and valves. Amongst the latter, the Hopkinson-Ferranti patent stop-valve is of exceptional interest. In this ingenious device, advantage is taken of the hydraulic principle embodied in the *vena contracta*. As the accompanying figure shows, the passage through the valve is contracted, so that the pressure of the steam is converted into velocity, and *vice versâ*, in the act of flowing through. By this means, a valve of half the ordinary diameter is enabled to serve the same purpose with equal efficiency. What this means will readily be understood when the enormous size of the valves on large steam pipes is considered; leakage, radiation and expansion are all reduced, and the

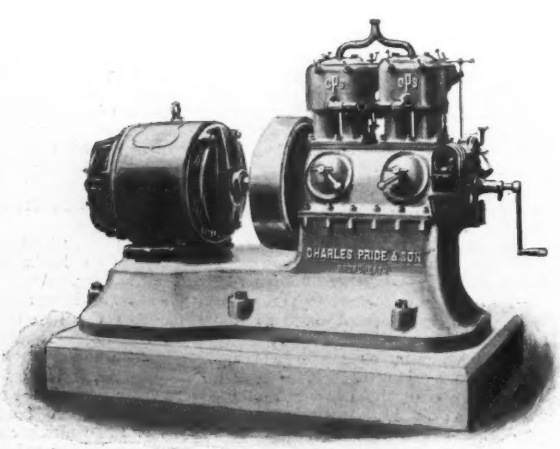


SECTION OF HOPKINSON-FERRANTI VALVE.

operation of the valve is greatly facilitated by its small size. The parts are small and easily handled, and the joint in the lid is far smaller. The construction of the working parts is also well designed, the disks being free to rotate on their axes, so that they are not liable to grooving, and when the valve is open, the seats are sheltered from the flowing steam. The contracted form of the casing facilitates lagging of uniform diameter with that of the pipes. Experiments on this and an ordinary valve show that an actually higher pressure was obtained in the cylinder of an engine driving a dynamo at 430 amperes, 550 volts, when the Hopkinson-Ferranti valve was employed, and an exhibit is arranged to show the marked reduction of size compared with the usual type of valve.

Charles Price & Son (176).

This company's exhibit consists of a Lancashire Dynamo Co.'s dynamo of 220 volts, 60 amperes, driven by a four-cylinder engine of 4 in. bore × 5 in. stroke, giving 23 B.H.P. at a normal speed of



PARAFFIN-ELECTRIC LIGHTING SET.

1,000 R.P.M. The set is self-contained on a substantial bedplate the fuel is paraffin, at about 3d. per gallon, but petrol may be used if preferred. Ignition is effected by a low-tension magneto, the tappets being operated by a patented mechanism which admits of easy adjustment, and is very compact and accessible; provision has been made for a supplementary ignition by a synchronised accumulator system if desired.

The cam shaft is formed solid with the cams, and is case-hardened, as also is the whole of the valve mechanism; it is driven by a spiral gear in this manner:—Between the wheel on the crankshaft and that on the cam shaft is fixed a transverse gear shaft, driving at one end the magneto, and at the other the governor, which is coupled direct to the throttle, and cuts off between 1,000 and 1,100 revolutions. Adjustment for wear is provided where advisable, viz., on the crankshaft bearings, the connecting-rod big-ends and the valve mechanism; the latter also is entirely interchangeable.

Lubrication is completely automatic, being effected by a force pump driven by the cam shaft and entirely enclosed within the crank case; it requires no attention whatever other than occasional replenishment of the oil.

Access to the crank case is obtained by two circular inspection doors of large diameter and readily removable. The dynamo is driven through a substantial "Oldham" joint, thus eliminating any possibility of hot bearings through side pressure. While there are no special novelties in the engine essentials, the makers claim that the design is on the soundest and best standard lines for four-cycle engines of this type.

Our illustration shows the set completely ready for coupling up, no other external rods or pipes being required.

Worthington Pump Co., Ltd. (158).

This exhibit consists in the main of one three-stage horizontal high-lift centrifugal pump, which is shown in operation, delivering approximately 600 gallons per minute against a head of 300 ft. when running at a speed of 1,200 R.P.M. The pump is driven by a Lancashire Dynamo Co.'s 75-B.H.P. motor, the whole being mounted on a cast-iron baseplate.

The main difference between this and other turbine pumps is that in the present case the pump is designed to eliminate the use of multiple guide vanes, the velocity of the water from the impeller being converted into pressure by means of a specially designed spiral diffusion passage leading to the delivery pipe. The number of wearing parts has been reduced to a minimum, without sacrificing efficiency.

The pump on exhibition can be increased in capacity up to a maximum of about 800 gallons per minute, with a corresponding increase in speed.

Several other types of Worthington centrifugal pumps are shown. One is a 6-in. medium-lift pump, which represents a line of pumps designed to work against a head of about 150 ft. in a single stage. The feature of this pump is the design of the special diffusion passage, which enables a high pressure to be obtained with one impeller.

An 8-in. low-lift pump represents the company's standard design for this service; it is provided with an impeller of the double-suction type, running in a cast-iron volute casing. This pump has been widely adopted for condensing plants demanding economical handling of the circulating water. It is designed so that an examination of the internal parts can be made without breaking the pipe connections.

The house tank pump is the smallest high-lift centrifugal pump built by the firm, being designed for use in large houses which are detached from any system of public water supply. In normal conditions this pump will deliver about 1,000 gallons per hour against a total head of 100 ft. when running at a speed of about 2,900 R.P.M.

Robert W. Blackwell & Co., Ltd. (60).

This company has an interesting exhibit of transmission line material. The stand will be specially notable by reason of the full size transmission line "A" pole shown. This represents a form of construction used by the firm in carrying out work for some of the largest power transmission lines in this country, some of which are now working at a pressure of 20,000 volts. A display is made of accessories for this kind of work, such as Lima porcelain insulators for all voltages up to 80,000, and all classes of galvanised wrought-iron work will be noticed fixed to the walls of the stand. The Lima insulators are particularly worthy of attention, as this make is very largely used in America and abroad. Lightning arresters of the horn type, with and without choking coils, are shown suitable for outdoor and indoor work; also non-arcing arresters suitable for switchboard work or for use in iron boxes. A new speciality is shown in the way of fibre conduit for underground mains, telephones, &c.; it is entirely different from any other on the market, having a thicker wall than usual and a longer spigot and socket joint. It is built up in alternate layers of fibre and asphalt and is laid in concrete. Full particulars are given in the firm's fibre conduit list, and a print showing the approximate quantity of cement and concrete materials per 100 ft. forward can be obtained by visitors. Messrs. Blackwell also show a new portable electrically-driven house vacuum cleaner, known as the "Kurkee." It is driven by a $\frac{1}{16}$-H.P. motor.

A good line is shown of Litholite insulation, for which the firm are the agents. This is of British manufacture, and it is now used by the Admiralty in connection with wireless telegraphy. They have also on view a good supply of tramway line material, insulating paints, insulating papers, cable boxes, bitumen compounds and asphalt roofings.

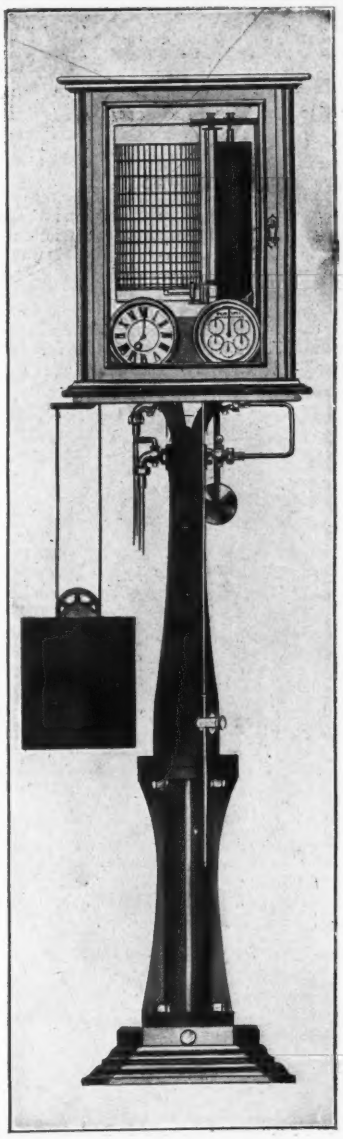
John Faulkner (264).

Mr. John Faulkner, of Manchester, lightning conductor manufacturer and erector, one of the oldest, if not the oldest, firms in the Manchester Exhibition, have an effective exhibit of some examples of copper wire rope and tape lightning conductors in various sizes suitable for public and private buildings, residences, steeples, towers and chimneys; also copper discharging points with elevating rods and protecting tubes, copper earth-plates and connections, and couplings for connecting branch lightning conductors to mains. Samples of lightning conductors fused by lightning, which have been removed from the Clifton & Kearsley Coal Co.'s chimney and Albert Memorial Church Tower, Manchester, are present. The portion of copper tape removed from the Clifton and Kearsley Coal Co.'s chimney has been hardened, this being one of the lost arts. Other samples show the durability of copper wire rope compared with tape for chimneys; there are two samples of copper tape removed from Messrs. Lever Bros.' chimney, Port Sunlight, after being in use only 10 years; also one sample of copper tape removed from Messrs. Rylands & Son's chimney, Gidlow Works, Wigan, after being in use only eight years. The samples of copper wire rope which were removed from the boiler chimneys of Crumpsall Workhouse and Messrs. H. & J. Beales had been in use for 30 years, and the electrical carrying capacity of the rope conductors was found to be greater than that of the copper tape that had been in use only eight and ten years. A model is shown of an octagon chimney fitted with lightning conductors complete, with copper wire rope, discharging points and earth plates. Another model illustrates an inexpensive method of scaffolding, which was first adopted by John Faulkner on the large spire of Lichfield Cathedral. Some illustrations of chimneys struck by lightning, and of steeples and chimneys undergoing repairs, will be examined with interest.

George Kent, Ltd. (117).

The main feature of this stand is the Venturi patent hot-water and boiler feed meter, provided with a combined diagram and counter recorder; this, therefore, gives both the rate of flow at any moment, and the total quantity that has passed through the meter, the accuracy being within 2 per cent. The appearance of the recording apparatus, which is mounted on a hollow pillar, is shown in one of the accompanying figures, while the other is a longitudinal section of the measuring device. The apparatus depends upon the principle of the *vena contracta*, and has no moving parts, while the obstruction offered to the flow of water is negligible. In flowing through the contracted passage the water gains velocity and loses pressure, the opposite conversion taking place in the expanding pipe; the difference of pressures between the broad and narrow parts is a measure of the rate of flow, and is ascertained by means of the annular chambers shown in the figure, from which small tubes are led away to the recording mechanism. The system is applicable to the largest water supply systems, as well as to ordinary power station requirements, and is extremely simple and reliable.

Other exhibits include meters fitted respectively with diagram and counter recorders only; a combined recorder for cold water; a mercurial manometer, and a weir recorder for measuring condenser water.



Venturi Combined Diagram and Counter Recording Apparatus.

Section of Venturi Meter Tube.

Vulcan Boiler and General Insurance Co., Ltd. (223).

This company shows the Vulcan fusible plug, with which, we understand, many thousands of boilers have now been fitted; it embodies a new principle in such fittings, namely, the conducting copper stem transmits the heat of the fire to the alloy, while the alloy itself is protected from direct contact, and the plug is so designed that the cavity of the shell is closed to the fire, and, consequently, cannot get furred up with hard baked soot, as is often the case with plugs of the ordinary open cavity type. A novel modification of this plug is also shown, which is adaptable to the upper drums of water-tube boilers or to the furnaces of gas-fired boilers. In this case, on the boiler becoming short of water, the alloy melts and the central copper cone drops on to a seating, cutting off communication with the fire, but at the same time opening communication to an alarm whistle; consequently all that is necessary in this type of plug on the occurrence of shortness of water is to shut off the alarm, make good the deficiency in the water level, and then proceed as before until a convenient opportunity occurs for replacing the plug; there is no necessity to stop the boiler.

Another interesting exhibit is the Vulcan patent gauge tester, which has been used exclusively for a number of years by the Vulcan Co.'s inspectors for testing gauges in connection with their ordinary duties of boiler inspecting.

There is also shown the Vulcan sector gauge and swivel siphon, and a handy hydraulic test pump, which is used by the Vulcan Co.'s inspectors.

F. V. Brown & Co. (34b, 35b).

On this stand is a large combined exhibit, dealing mainly with appliances for fuel economy, in which the firm are specialists. The "Sarco" specialities are shown, including the CO_2 recorder, draught and pressure gauges, feed-water meters and steam meters, feed-water analyser, bomb calorimeter and pyrometers, &c., made by Messrs. Sanders, Rehders & Co., Ltd. A new gas volume recorder is of special interest, being designed for use with suction gas plant, and, therefore, having to deal with hot and dusty gas; the recording steam meter is also worthy of note.

Another range of exhibits represents the manufactures of Messrs. T. H. & J. Daniels, Ltd.; a complete 16-H.P. suction-gas plant, supplying power to light the stand and to drive motor-driven pumps, is a prominent feature, and a 20-H.P. Daniels gas engine is shown. A vertical three-throw belt-driven high-speed Daniels pump is exhibited, fitted with the Gutermuth patent valve, which we have described on previous occasions, and which enables the pump to be run at 300 R.P.M., pumping 2,700 gallons per hour, against a head of 150 ft. A double-barrel sewage pump is also shown.

Lastly, the Hotchkiss automatic circulator, made by Messrs. A. Ross, Hotchkiss & Co., Ltd., is represented by a glass working model, showing the action of the system, with samples of deposit removed by the circulator from boilers, and samples of preservative compositions for boilers.

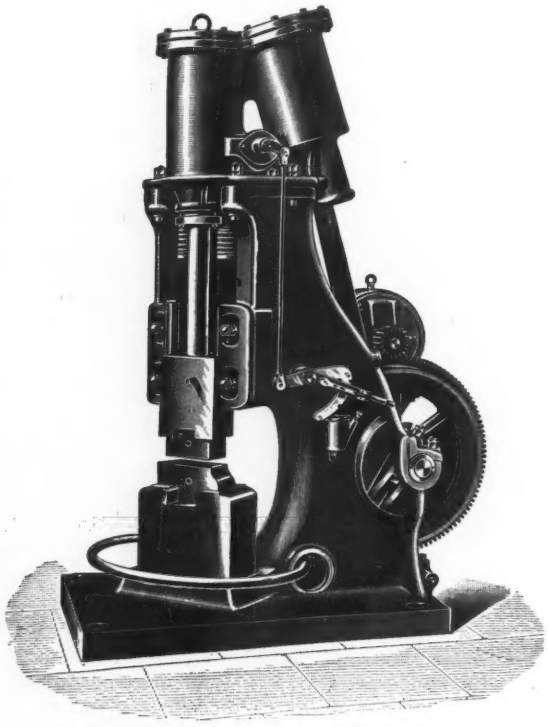
MOTORS and MOTOR-DRIVEN EXHIBITS.

[Further descriptions of Electric Motors and Motor-Driving Applications at the Manchester Exhibition are given below.]

B. & S. Massey (282).

This well-known firm of hammer manufacturers have on view a 3-cwt. pneumatic-power hammer, and a 3-cwt. friction-drop stamp.

In the pneumatic hammer, the steam pipe gives way to a double-acting air pump, which supplies air both above and below the hammer piston at each stroke; by means of a valve operated by a hand lever, the entrance and exit of air above or below the hammer piston can be exactly regulated so as to hold the tup stationary or cause it to deliver blows of varying intensity. This type of



MASSEY ELECTRICALLY-DRIVEN PNEUMATIC HAMMER.

hammer is particularly suited to electric driving, a small motor being mounted behind the standard and geared on to the fly-wheel rim. As an example of the economical working of these machines, 1-cwt. hammers average about 3 unit per shop-hour; a 3-cwt. hammer at Bolton averaged just over 1 unit per shop-hour; a 7-cwt. hammer at Manchester, doing 135 blows per minute, turned out some 44 forgings in 4 hours; and a 20-cwt. hammer, running during a 9-hour shift and dealing with locomotive and marine forgings, cost only 4s. 6d. in energy.

Maschinenfabrik Augsburg-Nürnberg.

This company is showing a number of photographs and diagrams relating to large gas engines and cranes. The diagrams demonstrate the amount of power which can be obtained—mostly for generating electricity—from the waste gas of blast furnaces and coke-ovens by the use of gas engines; one blast furnace, producing 250 tons of pig-iron daily, gives 10,000 B.H.P. continuously. One coke-oven of a daily capacity of 200 tons, with a regenerative furnace, in connection with Nuremberg small coal producers for the waste coke dust, gives up to 3,000 B.H.P. continuously. It is pointed out that England, with 2,000,000 B.H.P., would be able to produce approximately as much as Germany, but the actual utilisation is very small, for in consequence of the special conditions of the English mining industry—which has numerous blast furnaces without allied steel and rolling mills—large gas engines have not hitherto been so widely taken up as on the Continent. That the well-known Nuremberg gas engine, which is constructed in England by the Lilleshall Co., Oakengates, is especially noted on account of its reliability in working, is proved by the fact of the large number of installations, comprising over 300,000 B.H.P., in which it is employed.

Other pictures illustrate gas-engine plants constructed by the "M.A.N." for iron and steel works, collieries, and independent electricity works; these include two coke-oven gas power stations of altogether 4,500 B.H.P. in Bargoed and Brymbo (described in the ELECTRICAL REVIEW of May 22nd, 1908), the "M.A.N." workshops for large gas engines, the revolving tower crane of 100 tons capacity installed at Dublin Harbour, &c.

James Keith & Blackman Co., Ltd. (74).

The recently designed Keith pressure blower or exhauster for dealing with large volumes of air at low-pressure is a prominent object on the stand, where, as might be expected, fans and blowers abound in variety.

The latest Keith blower is designed to equalise the air discharge over the whole area of the wheel, and an enormously increased

MOTOR-DRIVEN REVERSIBLE BLACKMAN FAN.

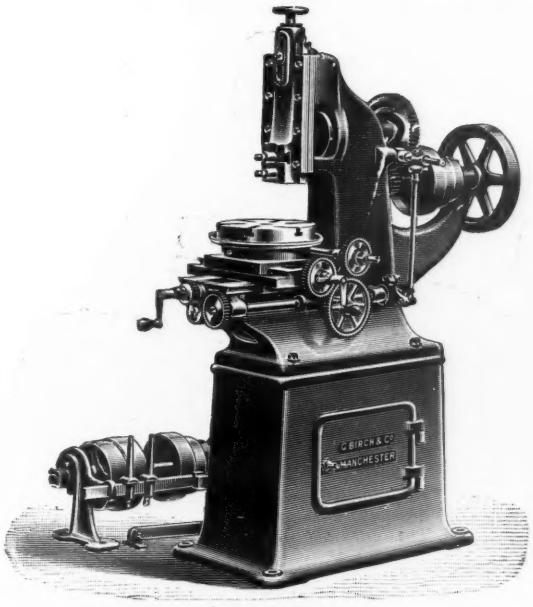
discharge is claimed for the arrangement. It is interesting to note that both fan cases and wheels are electric-rivet welded throughout. Other features which will attract attention are motor-driven high-pressure blowers for cupolas, forges, &c., the well-known smith's

BLACKMAN INDUCED DRAUGHT FAN.

hearth with blower attached, a reversible type of double-Blackman fan of very open construction, which has found favour for induced draught and flue use, also some Keith electric table fountains, the charming effect of which never fails to attract attention.

G. Birch & Co. (214b).

This firm has an interesting variety of machine tools on view, including a universal grinding machine, two slotting machines, a planing machine, a wire-mattress drawer, and a number of small tools for amateurs, &c. We illustrate a 4-in. slotting machine,



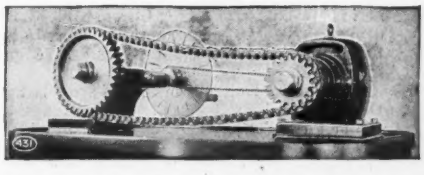
Birch Slotting Machine.

which, with its automatic feed and micrometer adjustment reading to ·001 in. on all slides, is a most accurate tool suitable for the finest work.

The other tools are equally well finished and are well worth inspecting. The machine for weaving wire mattresses is an advance on anything previously produced for this work; it runs continuously and will automatically finish to exact lengths of coil, re-starting again when the operator has cut off the finished coil.

Hans Renold, Ltd. (40).

It is almost needless to mention steel driving chains and accessories in connection with Messrs. Renold—the name and the chain are inseparable. In addition to the three main types of chain, viz., silent chains for high speed, roller chains for medium speed, and block chains for slow speeds, &c., photographs illustrative of their application are shown.



Rotoscope for Observing the Working of Chain Gearing.

A silent chain is shown in operation at about 1,000 ft. per minute, and by means of a rotoscope, visitors can satisfy themselves as to the meshing of the links and teeth; if further evidence of utility is needed, a visit to Messrs. Pollock & Macnab, and George Richards's machine tool stands will demonstrate their working capabilities.

The "Renold" chains are in use on several stands in the Exhibition for driving machines; examples of four different types may be seen, but in most instances the patent bearing silent chain is employed for driving machine tools, printing machinery, &c.

United States Metallic Packing Co., Ltd. (94).

Here, as would be imagined from the name, there is a variety of engine packings shown, but the more special feature of the Stand is to be found in a number of drilling appliances. These include the "C and I" portable electric drilling machine, for heavier and quicker work than hand drilling. It dispenses with flexible and telescopic shafts, drills holes up to 3 in. diameter, and is largely in use in engineering and shipbuilding works. The "C and I" hand electric drills (breast and screw feed) for ⅝-in. holes, and 1¼ in. holes respectively, designed for lighter work, also the C and I magnetic drill stand with tripod base, 2 feet being magnets and the third carrying a regulating screw (the drill operating between the two magnets), also forms part of this exhibit, as do the Bradford portable power drilling machine, the "Premier" steam trap, and the Butterfield steam cock.

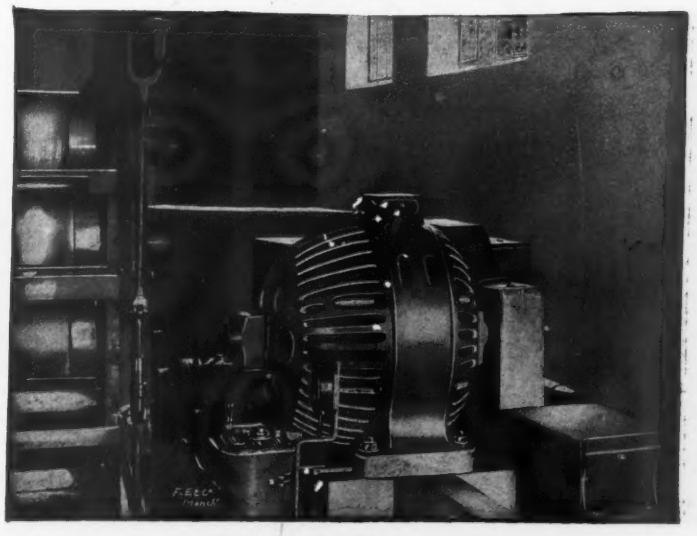
G. Harland, Bowden & Co. (92).

The exhibit on this stand consists principally of special motors and operating gear, as the firm make a speciality of designing and erecting complete installations for electrical driving of all classes of machinery for calico-printing works, bleach-works, iron-works, collieries, ship and engineering yards, &c. Two gears are exhibited to which special attention is called. One is a 23 B.H.P. slow-speed motor, arranged for driving a reversing planer, and is shown in motion, complete with the necessary automatic switchgear to secure reversal at the end of each stroke. It is specially designed for driving a 40-ft. plate edge planer which is capable of cutting 3½-in. steel plates ½-in. cut, at a speed of 20 ft. per minute, cutting with stationary tools on forward and return strokes, the total weight of the moving table and plates being about 12 tons. The powerful magnetic brake, the pulley of which is attached to the motor-shaft, automatically comes into operation directly the tappet switch is knocked over into the reverse position by an arm attached to the moving planer table. As the motor slows down and is almost at rest, the current is automatically reversed. This disengages the brake and starts the motor in the opposite direction almost instantaneously. The total time taken in the reversal of the whole of the gearing and table from full speed in one direction to full speed in the other is about 5 seconds.

The switchgear is such that the adjustments can be made to increase or decrease speed of reversal in accordance with requirements. The motor is fitted with interpoles and designed to give a very heavy starting torque.

Another motor is shown in motion coupled direct to a special triplex reducing gear. By means of this gear the motor speed of 1,500 R.P.M. is reduced to 75 R.P.M. A standard type of switchboard with three panels only is exhibited.

A number of other different types of starting and controlling gears are exhibited which are specially designed for works' use where heavy handling is met with. The following types of gear are exhibited:—One 12-H.P. 400-volt starting panel in metal case complete with ammeter, and including starter with magnetic blow-out and subsidiary carbon roller contacts, interlocked shunt regulator and double-pole switch. One 5-H.P. ironclad, 400-volt starter with "no-volt" and "overload" release; and one 30-H.P. ironclad, 400-volt starter with "no-volt" and "overload" release, and with slow action start. Other ironclad gear is also shown, amongst which are power distribution boards and motor switches.



Motor Driving Calender.

A model set of bevel gear with double helical machine-cut teeth is of interest, it can be turned by hand to demonstrate smooth and silent running entirely free from back-lash.

The accompanying illustration shows a finishing calender driven through spur gearing by a 50-B H.P. three-phase motor, which is installed in a Lancashire bleach works, and a feature of which is the gradual easy starting and steady running.

Frank Pearn & Co., Ltd. (179, 228).

Messrs. Pearn are showing their electrically-driven pumps and their latest design of patent high-speed surfacing and boring machine, the whole of the exhibit being in motion under working conditions.

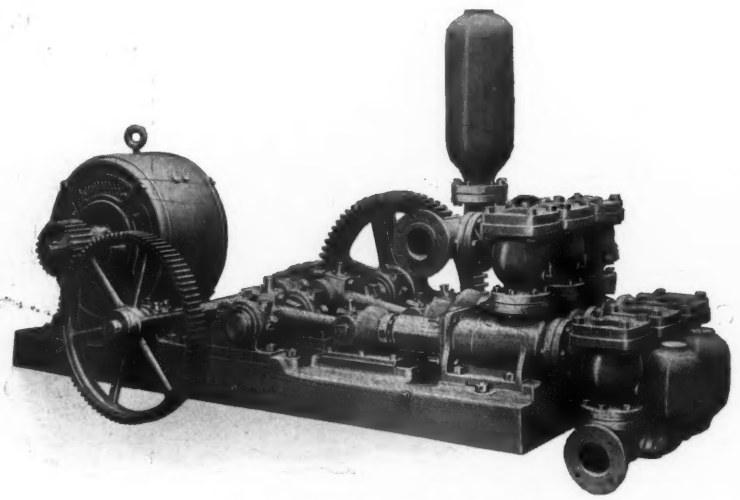
The pumps shown are triple, double and single-ram type, of both the horizontal and vertical patterns, and are all electrically-driven.

Our first illustration shows a horizontal three-throw ram pump, with externally packed rams, each 6 in. dia. The stroke of the pump is 8 in., and it will force 9,600 gallons of water per hour to a height of 600 ft. The ram barrels and valve chambers are cast separately, and are interchangeable. The rams are secured to cross-heads moving in guides; the gearing is machine cut, and the shafts and connecting rods are machined from solid forgings. The pump is driven by a 35-H.P. Westinghouse motor running at 750 R.P.M.

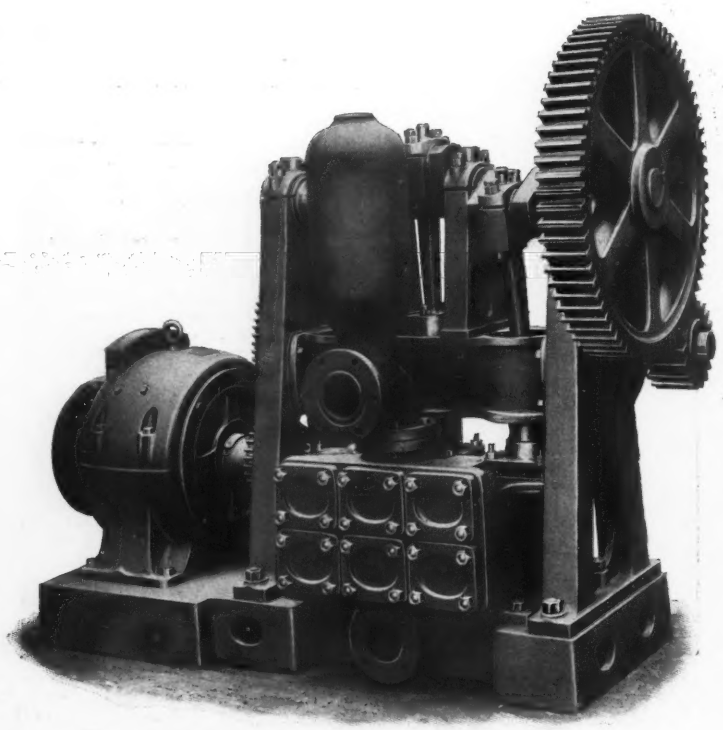
We also show a vertical three-throw ram pump with externally packed rams each 6 in. in diameter with a stroke of 8 in. The capacity of this pump is the same as that of the last named, but owing to questions of power supply, it is coupled to a smaller motor running at 600 R.P.M.

A feature in all the vertical pumps shown is that the ram barrels and valve chambers are all cast together, and each pump has embodied in it a suction vacuum vessel of ample proportions, thus effecting a great saving of space. This line of power pumps ranges from 2 in. diameter to 8 in. diameter, with one, two, or three rams, and is thoroughly standardised, so that the production is on economical lines and all parts are interchangeable.

The high-speed surfacing, boring, milling and drilling machine is driven by a 6½-H.P. Electromotors' motor, running at 650 R.P.M. The machine, which has a range of 24 speeds controlled by a speed-changing device of simple construction, and a range of eight automatic feeds all instantaneously changeable and reversible, is built on original lines, and will be viewed with interest.



HORIZONTAL THREE-THROW RAM PUMP.



PEARN VERTICAL THREE-THROW RAM PUMP.

Ebonestos Manufacturing Co. (197).

Here the visitor will find a great variety of moulded ebonestos insulators, the majority of the articles being switch-handles, bushes, tube ends and bases. As the material lends itself to the embodying of metal pieces, the company have made a speciality of terminal connection pieces in which the terminals and nuts are moulded into position. Over 8,000,000 insulators are now in satisfactory use.

The Electric and Ordnance Accessories Co., Ltd. (1, 62).

The company's stand contains an impressive display of motors and switchgear amongst other items. The motors are more especially designed for crane, hoist, lift and ventilating fan work, and a number of the "Ordnance" centrifugal fans are shown at work, including a large type designed for mine ventilation, &c.

The company's propellor fans are provided with blades of peculiar design, which are claimed to be especially effective in practice and to require a minimum consumption of power.

A 10-H.P. inter-polar motor and a 5-H.P. worm reduction set also figure on the stand. Possibly the most interesting section of the exhibit is the switchgear, which comprises starters, controllers, and apparatus for a variety of applications.

Standard patterns of starters for pressures up to 600 volts, fitted with the usual trip, and either open or closed, are shown, also a fool-proof type of starter, known as the "Autograd," to which special attention is drawn.

The "Autograd" starter is fitted with a self-accelerating gear which regulates the movement of the switch, and is operated by a simple electric device. We illustrate the company's combined quick-break lever switch and fuses, which are of the water and fire-proof pattern in a cast-iron case, and designed for circuits up to 600 volts pressure. In these switches the cover can only be removed when the switch is in the "off" position.

The controllers shown are suitable for a variety of uses; the direct-current controllers are all fitted with powerful magnetic blow-outs, and the cast-iron barrels or drums carrying the contacts are mounted on ball thrust bearings, with a view to easy operation.

In these controllers, when the barrel is in the "off" position, both poles are broken and the motor is entirely isolated from the mains.

The company make oil-immersed controllers for colliery work—the whole of the parts being carried on the lid of the oil tank, and thus being easily accessible.

A variety of smaller switchgear is shown, including several patterns of A.C. and D.C. circuit-breaker for currents up to 2,000 amperes and 600 volts pressure.

The Triumph Stoker Co. (9).

The company are exhibiting one of their well-known Triumph stokers, in motion, driven by a ½-H.P. electric motor. These stokers are in use at Bolton, Sunderland and other Corporation electricity works.

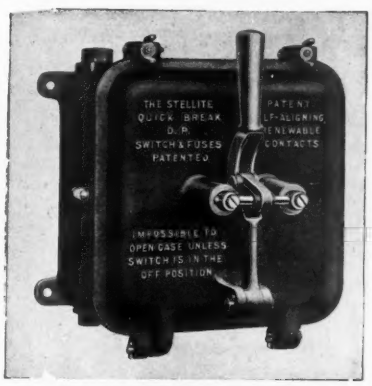
The company are also exhibiting, in conjunction with the stoker, Day & Wood's patent incandescent boiler arch—a fire-brick arch which is fitted inside the flues of tubular boilers at the point where the flame usually strikes the water-cooled surface of the flue. The arch becomes incandescent, and being directly in the path of the flue gases, brings about improved combustion, considerable increase in efficiency, and prevention of smoke. A series of tests carried out by the staff at the Bolton Corporation electricity works shows that the adoption of the arch resulted in 15 per cent. increased evaporation, with a decreased coal consumption of 6 per cent. and an average CO_2 record of 13 per cent.

Charles Churchill & Co., Ltd. (292).

This firm are showing a variety of machine tools, including portable electric drills and grinders of the self-contained pattern, arranged for connecting by means of flexible and plug to any incandescent lamp socket.

The portable grinders are suitable for grinding centres, cutters, dies, parallel surfaces, &c., and the drills vary in range from ¼ in. to 2 in. dia. hole.

A Lodge & Shipley lathe, the Hugon pipe bender—which is particularly advocated for bending thin tubes, and a variety of magnetic chucks suitable for handling delicate and fragile work in grinding, milling and planing machines, are also worthy of notice.



Stellite Enclosed D.P. Switch-Fuse (see p. 704).

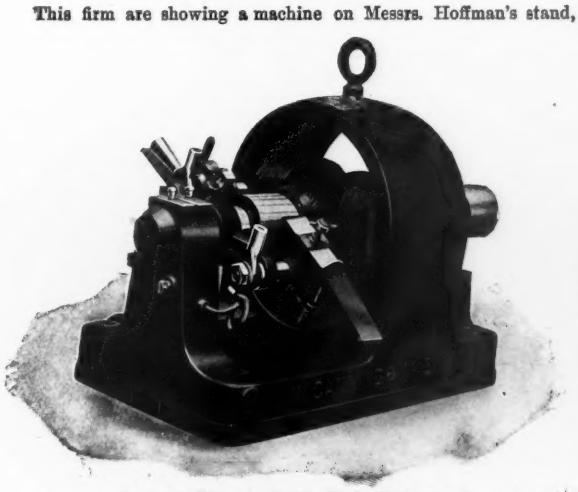
James Hodgkinson (Salford), Ltd. (243).

The stoker exhibited by this company will subsequently be sent to the electricity works at Vienna, for which it is on order; two similar machines are already fixed, and have undergone a series of tests in a very successful manner. They have been using an exceedingly inferior quality of fuel with which no other machine has ever been successful, neither is it practicable to use it with hand firing. In a test carried out on July 28th last, for a period of six hours, the total water evaporated was 6,500 gallons, and the fuel consumed over 9,000 lb.; this gives 1,083 gallons of water per hour, against 1,563 lb. of coal, showing 7 lb. of water per lb. of fuel used. The temperature of the feed water was 88° before, and 233° after the economiser, and the average steam pressure was 201·5 lb. per sq. in.

Another feature of the exhibit is Collinge's patent automatic coal-weighing machine. This is a very simple and reliable apparatus for recording the amount of coal fed to each individual boiler, or alternatively to a range of boilers fed direct into the elevator boot. The coal is brought from the bunker by means of a short spiral conveyor, and the weighing box is accurately balanced on the usual knife-edge arrangement. A number of these can be seen a few minutes from the Manchester Exchange, under actual working conditions.

W. Canning & Co. (126, 165).

This firm are showing a machine on Messrs. Hoffman's stand,

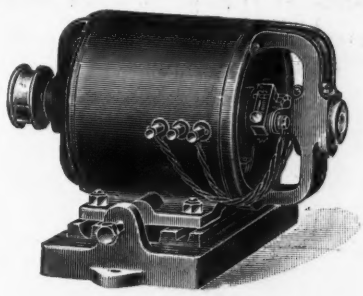


Plating Dynamo with Ball Bearings.

fitted with the latter company's ball bearings. The arrangements adopted were shown in detail in our issue of August 21st last.

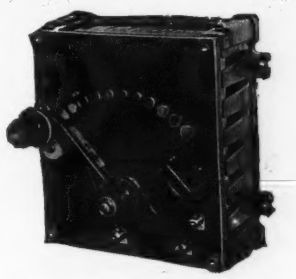
Small Power Dynamo and Motor Co. (219).

The company is showing a standard A.C. to D.C. transformer consisting of a motor and generator mounted on a common bedplate, and having an efficiency of 70 per cent. This, and a similar D.C. to D.C. set, which is exhibited, we have already illustrated. A D.C. motor, which represents a line of standard dynamos and motors, is another exhibit, as illustrated herewith; and a number of motor starters are on view. One of the latter is shown in the accompanying figure; this is of the open type, with incombustible units of



D.C. Motor.

non-oxidisable material mounted on stout glazed porcelain cylinders. There is no asbestos in these starters, and no soldered joints. The

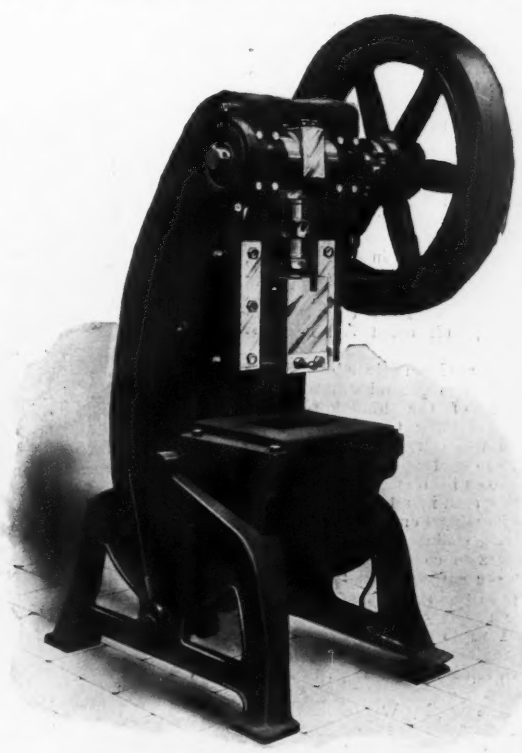


Open Type Motor-Starter.

semi-enclosed starter has a hinged front, which opens over the handle; this feature is also met with in the gas and water-tight starter exhibited.

J. Rhodes & Sons, Ltd. (30).

Several examples of the "Rhodes" power press are shown by this firm. Our illustration shows the salient features of these



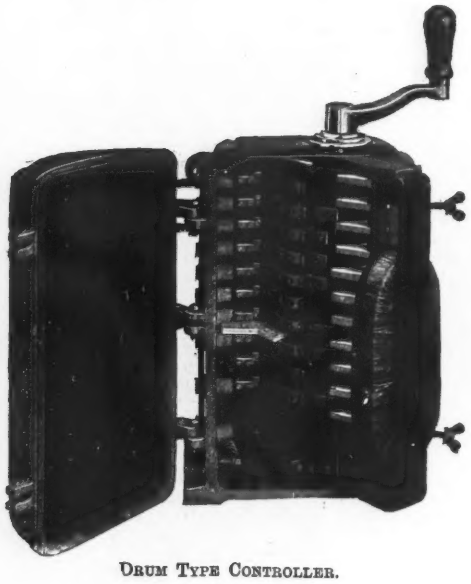
"Rhodes" Power Press.

machines, which are fitted with a patent safety clutch, strongly favoured by H.M. factory inspectors.

That the machines are built on sound lines can be gathered from the fact that Messrs. Rhodes were recently awarded an order for 76 of them by a Continental Government.

General Electric Co., Ltd. (132, 162).

Prominent among the General Electric Co.'s exhibits are the 600-KW. motor-generator shown in the Exhibition sub-station, and used for transforming the three-phase 6,600-volt 50-cycle supply of the Corporation to direct-current at 500 volts for Exhibition use, and a similar but smaller set—one of three built at Witton for the new Osram lamp works at Hammersmith—shown on the stand.



DRUM TYPE CONTROLLER.

In the larger machine, the armature and the rotor are mounted on one cast-iron spider, thus doing away with the middle bearing, and the other two shaft bearings are fitted with twin ball races, an arrangement which obviously facilitates starting up and efficient running. The approximate weight of this set is 30 tons.

The principal motor-generator on the stand has an output of 100 KW., at 220 volts pressure on the direct-current side; near it is a midget set consisting of two of the smallest G.E.C. direct-current machines arranged for charging motor-car accumulators and similar work.

A number of the company's standard productions in both direct and alternating-current machines are on view, and particular mention may be made of the ball-bearings which form a special feature of many of the machines.

Mention may also be made of a special gas-tight coal-cutter motor and a gas-tight motor for use in fiery mines and similar places.

With the motors are shown a variety of standard starters, in semi-enclosed, water and gas-tight covers, also tramway drum-type controllers, liquid starters, and ordinary enclosed and gas-tight, oil-cooled auto-transformers.

A Northrop loom driven by a Witton motor, attracts general attention; the motor is of the hinged type, its weight providing the necessary tension in the belt, and compensating for slip in starting-up.

The loom itself is an example of the modern trend in all machine design, being largely automatic in working.

Its most striking feature is a battery or magazine containing 25 bobbins, which are automatically fed into the shuttle to replace exhausted bobbins; as the supply of weft can only last from 1 to 20 minutes, it is evident that the magazine saves considerable attention on the part of the operator.

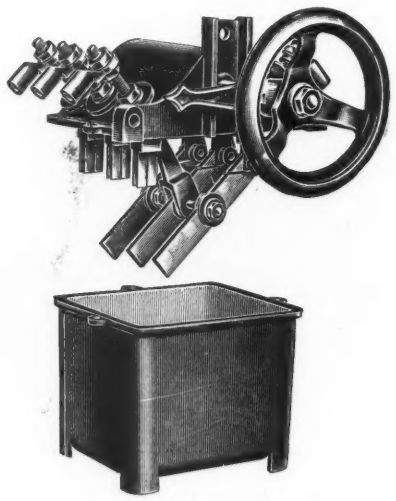
On the whole, Witton machinery is well to the fore in the Exhibition, as it is conspicuous on a good many other stands where motor-driven machinery is shown.

The company are also showing various types of their switchgear, including examples of remote control apparatus.

A typical H.T. generator panel on view contains, in addition to the ordinary indicating instruments, a magnetic blow-out closing switch and a closing switch for operating the trip coil. The operating switch is of the push-button type and the shortest contact effectively operates the circuit breaker (which is of the oil break type); switches of this type are in use at the Bradford Corporation generating station, their operation being so rapid that they are regularly used for synchronising.

The oil switch has a double toggle motion for exerting the necessary pressure between the contacts and for locking purposes; the tank is of sheet steel, with a wood lining and wooden partitions between phases.

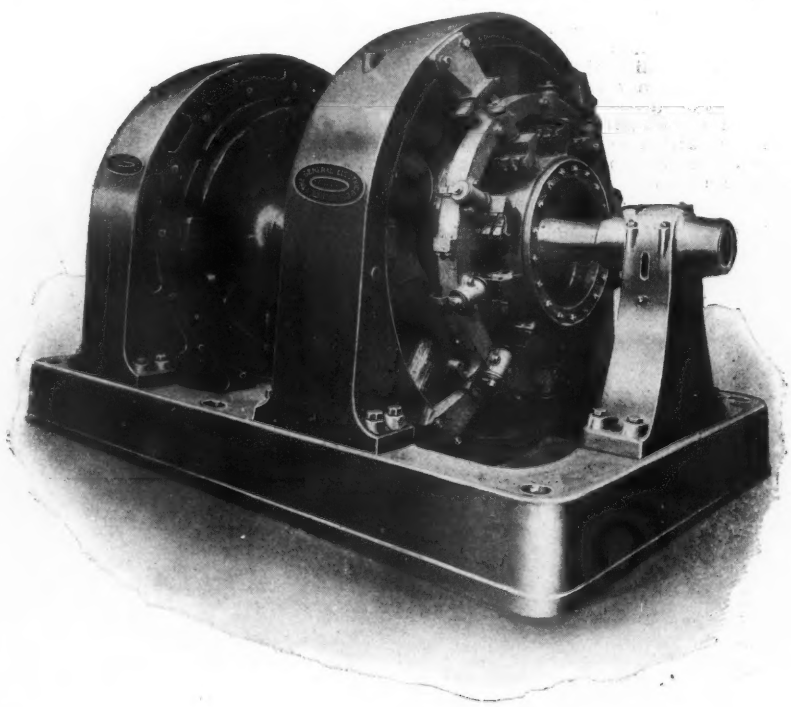
The instruments fitted are manufactured under Dr. Sumpner's patents, and we understand that a synchroniser working on the same principles as adopted by Dr. Sumpner, is now being placed on the market by the company.



THREE-PHASE OIL SWITCH, WITH TANK REMOVED.

The oil switch is fitted with a time-limit relay on the solenoid principle, the company having adopted this in preference to the induction principle, which has a certain amount of complication; the complete apparatus is suitable for pressures up to 15,000 volts. An oil switch suitable for lower pressures, has been designed for factory and mining work; this can be equipped with overload and low-voltage automatic attachments.

The company also show examples of their standard ironclad watertight switches, suitable for mining use; the cable receivers and sealing ends are standardised for fixing to any of their ironclad switches or distribution panels, &c.

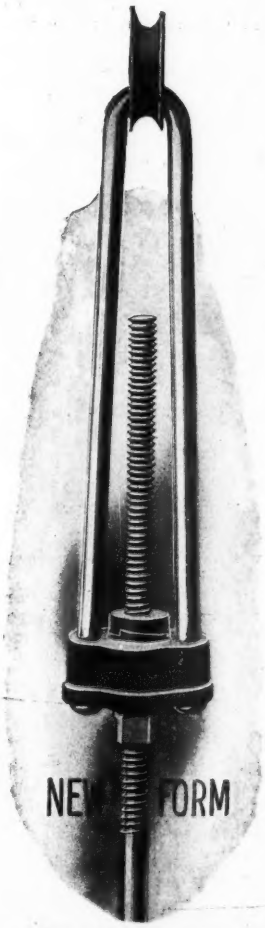


G.E.C. 100-KW. MOTOR-GENERATOR.

MISCELLANEOUS EXHIBITS.

Bullers, Ltd. (29, 40).

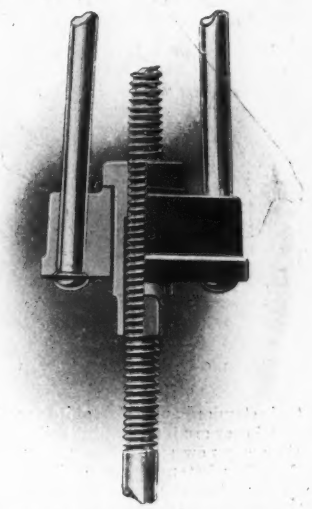
The leading features on Messrs. Bullers' stand are porcelain insulators, of beautiful whiteness and high finish. These include a wide variety of shapes and sizes, from the smallest line insulators to immense insulators designed for the Zambesi high-pressure transmission, and from arc lamp resistance bobbins to leading-in tubes, &c. The essential feature of their electrical porcelain is that it is absolutely vitreous, no matter what the purpose to which it is applied; they have made a special study of the subject for years, and have attained to the first rank for excellence of material and workmanship.



Bucknill Patent Crosshead.

We illustrated their high-pressure line insulator in our article on the Midland Railway; similar insulators, as well as others of various makes, were tested in our presence on the firm's stand, where a high-pressure Westinghouse transformer with regulating apparatus has been erected, together with a tank. The latter is surrounded with glazed sides, to prevent splashing the surroundings when drenching the insulators with artificial rain, and as a result the insulators became moistened over their whole surfaces, while the air in the enclosure was ionised by brush discharge. Both these conditions are exceptional, and render the tests unduly severe. An insulator designed for a 20,000 volt transmission line, nevertheless, withstood up to 50,000 volts before sparking over, when exposed to a slanting shower of spray, and did not spark over with 72,000 volts (the maximum available) when dry. A much simpler two-shed insulator of Messrs. Bullers' own design gave a similar result; and an insulator with a large enamelled-iron umbrella on the top withstood 57,000 volts for a considerable time, in a drenching shower, before sparking over.

Other exhibits on this stand were a new patent ventilating cover for manholes, giving exceptionally good results; an illustration of this is given herewith. It will be seen that round the rim and round each slot in the cover there is a raised lip, turning away water flowing over the surface. Direct rainfall has little effect—so little that the bucket need only be emptied at the usual inspectional visits. We understand that these covers have been tried by several authorities with remarkably satisfactory results. They are secured by a simple lock, the key of which cannot be removed until the fastening has been closed. Experiments made with the cover have been described in our issue of March 20th, 1908.



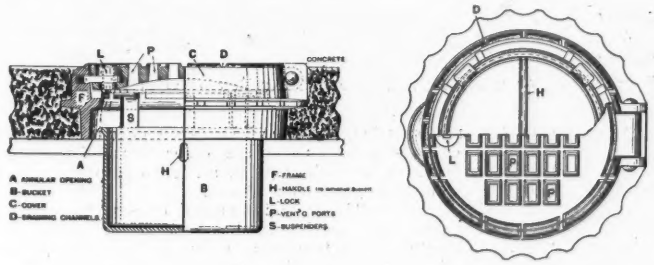
Section of Bucknill Crosshead

The new patent crosshead for stays invented by Colonel Bucknill is shown by Messrs. Bullers, and is illustrated herewith; it will be seen that instead of turning the nut by a spanner between the sides of the bow, as in the old style, the nut is prolonged through the crosshead, so that the sides of the bow can be brought closer together, and the nut can be turned with facility without taking off the spanner. Patent removable pole steps, and other devices, are also exhibited.

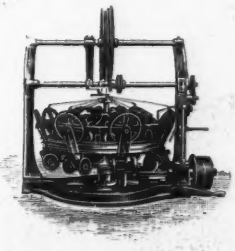
Standard Machine Works, Ltd. (239).

This firm's exhibit consists of high-speed braiding machines, used in the electrical trade for cable covering, and in the textile trades for various purposes. The principle of the machine is one very rarely used, and is of interest to the engineer. It is claimed to be the only principle at present in use which will allow a braiding machine to run at a high speed.

The advantage of a high speed in cable covering is great, enabling long lengths to be run through in a short time without cutting. In dealing with rush orders, a cable manufacturer is often delayed through having to wait for the braiders when his machines are of the old type. All the motions are rotary. The machines are claimed to be simple to run and cheap to maintain, and they are built entirely at the firm's works at Nottingham.



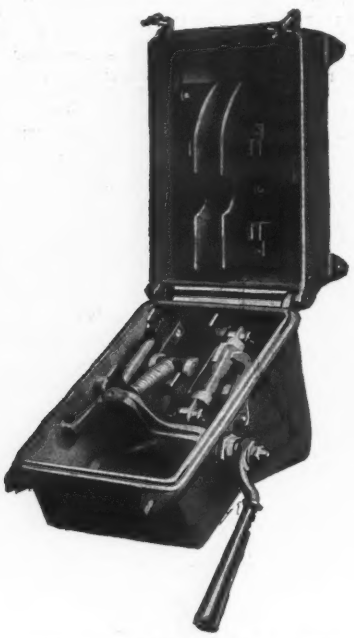
Section and Plan of Bullers' Patent Manhole Cover.



High-Speed Braider.

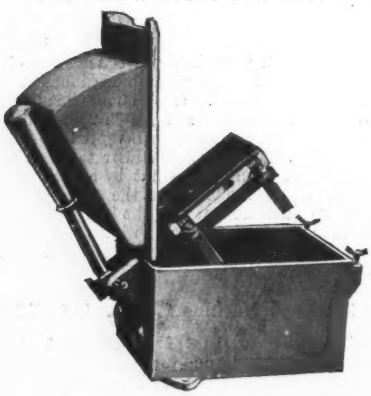
Parmiter, Hope & Sugden (159, 135).

An exhibition of this kind may be expected to give a special stimulus to the production of new specialities, a direction in which Messrs. Parmiter, Hope & Sugden are not behind-hand, for in addition to their standard apparatus, quite a number of new designs in ironclad switchgear are included in their exhibit.

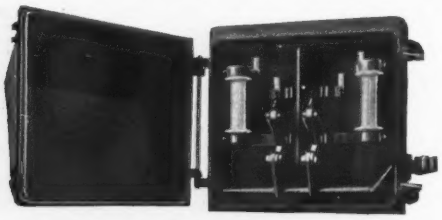


"SPRING-ON" SWITCH-FUSE, OPEN.

Amongst the many new specialities the one that calls for first mention is Hope's "Patent Spring-on" switch-fuse (see figure), which has many special features. It has a very quick make and break, and both are independent of the operating handle, whilst the quick-break and knock-off is mechanical and is independent of the spring. This switch-fuse is gas-tight, and is interlocked to comply with the Mining Regulations. The whole of the operating mechanism is contained in the lid; consequently, when the fuses require renewing, the fuse contacts are necessarily in a position clear of all live parts. The special feature of the whole arrangement is the easy and sweet operating motion, whilst it is particularly positive in action. The "Spring-on" switch-fuse is constructed on the same lines as Messrs. Parmiter, Hope & Sugden's other well-known Ajax mining gear, and can be supplied double or triple-pole as required.



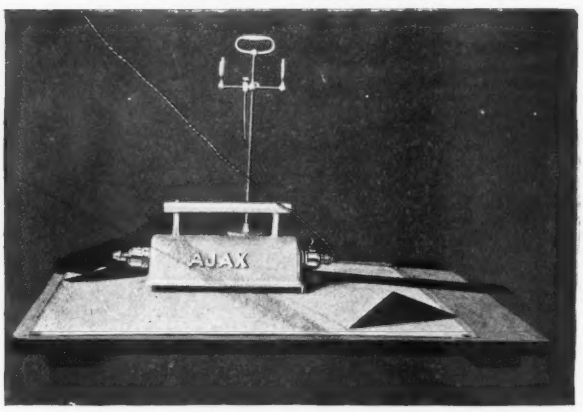
AJAX SWITCH-FUSE.



AJAX DOUBLE-POLE SWITCH AND FUSES.

Another new form of ironclad switch which the firm have put on the market is known as the Ajax "H" type. This switch is of the dust-proof pattern, and of specially strong mechanical design. It is useful as a house-service switch for small installations.

Somewhat similar in design to the above is Hope's "Patent Ajax switch-fuse" (see figure), which is now ready in some sizes. This switch-fuse is a neat and compact arrangement, particularly suitable for small motors, &c., the special feature being the moulded solid carrier into which the spring-clip replacement fuses fit, and in which they are held in place by phosphor-bronze clips. It is claimed that it is impossible to touch any of the live parts when renewing the fuses. Owing to the saving effected in wiring, and the compactness of the arrangement, switches and fuses in the same case are becoming more and more popular, and Messrs. Parmiter, Hope & Sugden have now put on the market a complete range of gas-tight interlocked switches and fuses combined in one case. These are their well-known Ajax S-type switches with C-type fuses, illustrated herewith.



DRAWING-OFFICE LAMP AS DRIER.

Motor-starting panels of every description form a feature of the exhibit. The standard patterns are semi-enclosed and totally enclosed, on iron frames, but the firm also make every form of self-contained starting panels; they have standard patterns with ammeter, D.P. switches, fuses and starter, and similar panels without the starters, and there are other forms for special requirements. Main switchboards and all forms of power distribution boards in iron cases are also shown.

AJAX 3-POLE SWITCH AND FUSE BOX, COVERS INTERLOCKED.

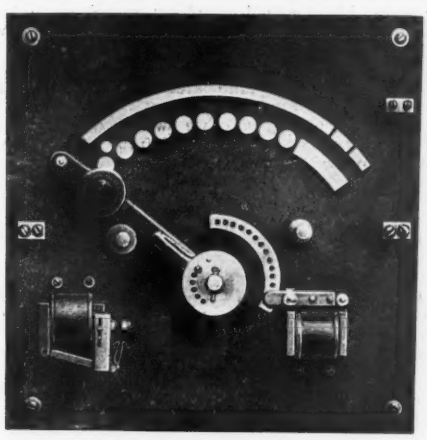
The Ajax drawing office lamp is mounted on a portable stand with tilting device, and an aluminium reflector, and is arranged so that it can be stood on a tracing, as shown in the figure above, drying the ink very quickly. This is quite a new device.

Messrs. Parmiter, Hope & Sugden are also exhibiting on behalf of the firms they represent in Lancashire and Yorkshire, viz.:—The Gilbert Arc Lamp Co., Ltd., Chingford, flame lamps, enclosed lamps and accessories; the Electric Control, Ltd., Glasgow, Empire automatic starting switches, for both alternating-current and direct-current circuits; and the Premier Electric Control, Ltd., London, special motor-starting gear and controllers.

Premier Electric Control, Ltd. (159, 135).

The Premier Company's apparatus, as the name implies, consists of switchgear for motor control. The special objects at which they have aimed in their designs are simplicity, and ease

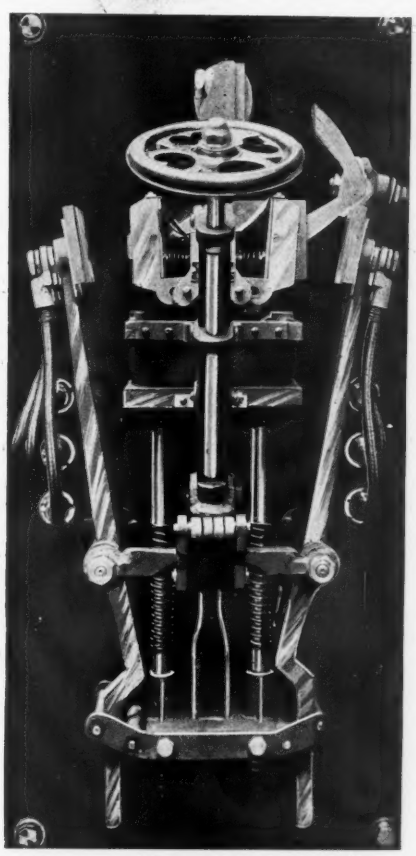
of repair and adjustment, so that the ordinary user with or without any knowledge of electrical matters can readily carry out such



Series Starter and Regulator.

small repairs, &c., as become necessary in course of time. Thus the contact springs can be renewed with the greatest ease, and the main spring can be set up by a simple device, consisting of the drilled plate shown on the pivot of the lever. In the larger sizes of starter, flipper sparking pieces are provided, which can be renewed with the greatest facility; the small sizes have carbon rollers similarly arranged.

The contact lever, when full over, is held by a mechanical device with a magnetic lock, so that it cannot be shaken off by vibration; and in the series starter and regulator, shown herewith, the lever



"Premier" Multiple-Lever Rheostat.

is held at any contact by an ingenious little detent consisting of a steel ball held against a drilled steel plate by the no-volt release, so that in case of interruption of the current or overload the lever returns from any position to the "off" position.

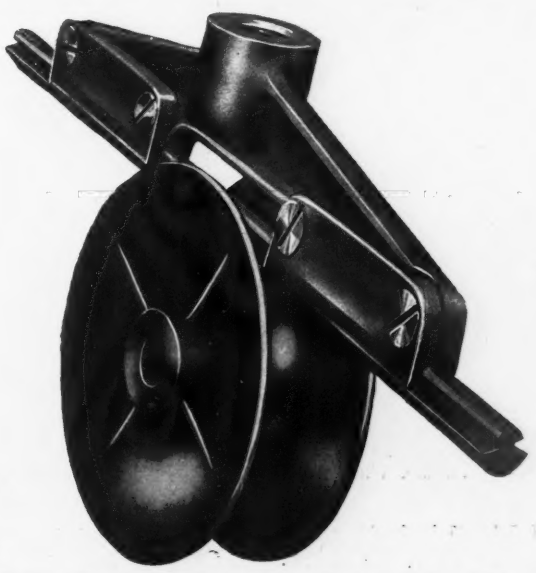
The "Premier" multiple-lever rheostat, which is illustrated above, has no sliding contacts, the clapper contacts being of carbon; they are brought into action successively by the rotation of the hand-wheel, a copper leaf switch finally short-circuiting the resistances. Many of these have been supplied to the L.C.C. sub-stations. Automatic no-volt and overload release attachments are provided. We have by no means exhausted the list of the company's apparatus, which includes ironclad rheostats, controllers, &c.

The British Insulated and Helsby Cables, Ltd. (41, 28).

The exhibit of the B.I. and H. Co. is full of interesting items, from which we can do no more than make a selection. The stand itself should be visited.

Perhaps the most striking feature is the full-size reproduction of a high-pressure three-phase transmission line, for 20,000 volts, as erected by the company for the Cleveland and Durham Co. and others in various parts of the world. The poles, which are 11 in. in diameter, are shortened to bring the line construction near the observer's eye. Two H poles form the terminals, with a single pole in the middle of the stand; they are fitted with channel-iron cross-arms, and carry the conductors at the angles of a 5-ft. triangle on porcelain insulators and shackles. Two of the conductors are of copper, ·372 in. in diameter; the third is of aluminium, ·480 in. in diameter, of equivalent section to the copper. The company is using aluminium wire and tape for many purposes, and in addition to its extensive plant for smelting, rolling and drawing copper, has put down rolling mills and wire-drawing plant specially for dealing with aluminium, which figures prominently in the exhibit. Joints in aluminium wire are made by welding with a blow lamp, for which purpose a neat little patent holder is used, which automatically closes the joint when a welding heat is reached. Aluminium cable is jointed in a similar manner. Copper in all stages of manufacture into wire, as well as aluminium bus-bars, wire and tape, is shown.

A noteworthy feature of the exhibit is the patent grooved trolley wire of which the company makes a speciality, together with the various mechanical ears, section insulators, &c., devised for use with it. We illustrate a section of line with an ear, showing their



Prescot Mechanical Ear and Non-Fouling Trolley Wire.

relation to the trolley wheel, and the shape of the cross-section of the wire. Inspection of the actual thing shows that there is absolutely no possibility of fouling, the path of the trolley wheel being perfectly uniform. The ears cannot come off through vibration, the screws being cupped so that their ends can easily be riveted over. The ears are cast of a highly ductile alloy consisting almost wholly of copper, and are designed with a view to lightness and strength. The frogs, section insulators, &c., made by the company also have distinctive features of merit.

A number of Prescot paper pinions are shown, including one which has been working for four years, transmitting 40 B.H.P. at 600 R.P.M. almost continuously, day and night; the teeth show very little wear, and are highly polished. This pinion will be put back into service after the close of the Exhibition. These pinions are made of Manilla paper powerfully compressed between stout gun-metal checks, and are practically unaffected by moisture, oil or temperature changes, being in many respects, therefore, superior to raw-hide pinions.

To the wide range of house service fuse-boxes exhibited we can only make a passing reference; the company makes an enormous number of these, the output approaching 40,000 per annum. The stand is lighted by eight Prescot flame arc lamps, running four in series on 200 volts D.C., and these lamps are also used on the Lancashire Dynamo and Motor Co.'s stand. Quick-break switches and plug fuses are shown, including Hornby's patent switch fuse, in which the ordinary knife blade is replaced by a combination blade and enclosed fuse. A number of naval switches, plugs and sockets, designed for the Admiralty, are exhibited.

We have already described the Prescot feeder pillar; the design of this has been greatly improved, and a sample set of cable fittings is shown on the stand. In order to avoid difficulties with the cable ends, it has been found best to terminate the actual cable in a chamber beneath the pillar, where it is jointed to the end of a cable running up inside the pillar. One of the great

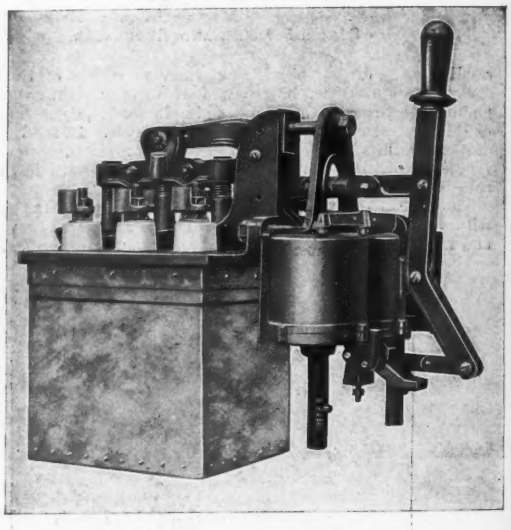
advantages of this pillar is that rubber tails and pot ends are dispensed with entirely.

The Mordey-Fricker electrolytic prepayment meter and the Fricker demand indicator are shown, as well as the Mallins patent tramway ticket punch—a most ingenious and effective device, which has a magnetic lock, and is provided with various safeguards against fraud being committed, either by or on the conductor. Already 1,400 of these are in use on the Liverpool Corporation tramways, and the instrument deserves the close attention of tramway managers. Helsby motor-car tires and tubes, golf-balls, and exploders we can only mention. A safety hand lamp designed to meet the recommendations of the Home Office, detailed in Mr. Ram's recent report (see ELECTRICAL REVIEW, Aug. 14th, 1908) and provided with general improvements is shown, and is illustrated herewith.

Two examples of the Prescot welder are shown at work; this machine has been developed to a high degree of perfection, being provided with scales for setting the jaws, which close the weld automatically, at the same time cutting off the current. Ball bearings are employed to reduce friction to a minimum, and the process is very rapid—a weld occupying only 5 seconds, with a maximum load of about 3 H.P. No. 4 welder is designed for wires

PRESCOT WELDER NO. 6.

SAFETY HAND LAMP.



REYROLLE OIL-SWITCH WITH OVERLOAD AND NO-LOAD RELEASES.

·005 to ·25 in. in diameter; No. 6, which we illustrate herewith, takes iron up to ¾ in., and besides welding together different metals, is shown doing "spot welding," a process which takes the place of riveting in the manufacture of sheet-iron and hollow ware, being infinitely cheaper, more effective, and quicker.

The Bates & Peard patent annealing furnace is made by the B. I. & H. Co., who show a small one suitable for dealing with small articles. This furnace anneals copper, brass and other non-ferrous metals in an atmosphere of steam, with the result that the articles are annealed absolutely without the formation of scale, saving time and money.

Another exhibit of extreme interest is a wire-drawing machine designed by the company, in which copper wire can be drawn down at one operation from ·0084 in. to ·0018 in. diameter, passing through 17 diamond dies in succession. The machine, nevertheless, is extremely compact, and is driven by a 1-H.P. motor.

An interesting and, for this country, unique exhibit is an extra-high-pressure air-break switch, made for the Midland Railway Co.'s overhead transmission line at Heysham. It is intended to break circuit at 200 amperes and 10,000 volts, and is provided with a double break and sparking pieces of the horn type, carried on English porcelain insulators tested to 20,000 volts. The switch is fixed on the top of a pole, and is operated from the ground with a rod.

The extensive telegraph and telephone exhibit of the company will be dealt with in our next issue.

British Westinghouse Electric and Mfg. Co., Ltd. (79, 81).

This company has two switchboards for alternating and direct current, respectively, on view, in addition to a variety of smaller switch work described last week.

The direct-current board is represented by a 1,000-ampere panel with circuit-breaker, ammeter, &c.; the alternating board consists of three white marble panels equipped with instruments and switches suitable for high pressures.

A. Reyrolle & Co., Ltd. (95).

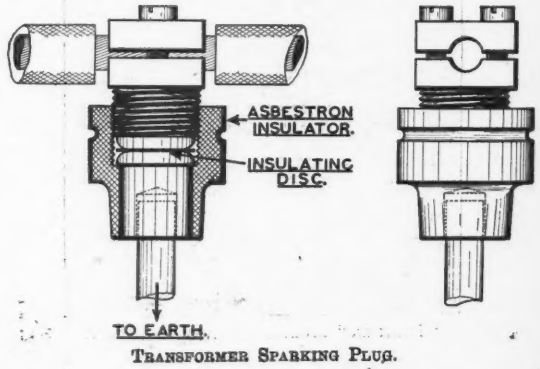
The chief exhibit on this company's stand is the new ironclad switchgear, to which we shall refer later, as well as to the motor-controlling switchgear exhibited. For the moment we will deal only with the minor items shown.

An entirely new device is a voltage detector, made under the Thornton, Clothier and Reyrolle patents, and consisting of a spark gap in series with a condenser, in the shape of a long rod, convenient for use in cellular and other switchboards. The device is adapted for pressures from 3,000 to 12,000 volts, and its use involves no danger whatever to the operator.

Two prepayment meters are shown; the Hikeley hour-meter, which simply closes the consumer's circuit for a fixed period of use, regardless of the current, and the Highfield prepayment meter, which is largely used by the Metropolitan Electric Supply Co., and goes a step further than the former.

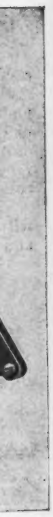
The company's standard switchgear is exhibited, including a variety of their switch fuses, &c., some with special ventilation to prevent heating of the porcelain holder; cast-iron wall-plugs for workshop use, cable-dividing boxes, &c. A new sparking plug, for safeguarding against an accidental connection between the primary and secondary of a transformer, is illustrated below; it consists simply of a thin disk of insulating material interposed between the secondary circuit and an earth terminal. A six-way 100-ampere distribution box, similar to the 28 boxes in use on the feeder circuits in the Exhibition, and an improved form of high-pressure fuse contact, with front connections, are shown.

On the switchboard there is a tank oil-switch with overload release on two phases and a no-volt release, as shown in the accompanying figure, the no-volt attachment being fitted in the middle. Other exhibits include a standard panel for a three-phase line, with time-limit fuses, shunting relays for maximum load, cut-outs, and standard service and multiple-way boxes with patent terminals; and the Merz-Price feeder protection system, which we described fully in our issue of August 28th, 1908, is shown in actual operation, forming a very interesting demonstration.



TRANSFORMER SPARKING PLUG.

Printed by WILLIAM CATE, LTD., Hogarth House, Bouverie St., and Published by the Proprietors, H. ALABASTER, GATEHOUSE & Co., at 4, Ludgate Hill, London.



CONTRACTS OPEN.

(*Continued from page 694.*)

London.—October 27th. Twelve water-tube boilers with mechanical stokers, superheaters, &c., for the L.C.C. See "Official Notices" October 2nd.

November 2nd.—Stores, fittings, carbons, &c., for the L.C.C. See "Official Notices" to-day.

Manchester.—October 28th. High-pressure steam and feed pipes, valves and supports, for the Corporation. See "Official Notices" October 16th.

Roumania.—Craiova.—December 20th. Tenders for the building and working of an electric tramway system. Deposit 50,000 fr. Particulars of the Conseil Municipal.

Salford.—October 26th. Electric light installation at the Seedley Baths, for the T.C. (Deposit 10s. 6d.) Mangnall and Littlewood, architects, 42, Spring Gardens, Manchester.

November 2nd.—Cooling towers, tanks, &c., for the Corporation. See "Official Notices" October 16th.

Spain.—October 30th. The municipal authorities of Pontevedra are inviting tenders for the concession for the establishment and working of a telephone exchange in the town during a period of 20 years.

Huelva.—November 17th. Tenders are invited for the supply of four electric cranes and a travelling crane for this port. A deposit of 5 per cent. is required. Further particulars of the Junta de los Trabajos del Porto.

CLOSED.

Argentine.—The British Westinghouse Electric and Manufacturing Co., Ltd., have received an order from the Buenos Aires and Pacific Railway Co. for the complete construction and equipment of a large power station, with several sub-stations, for the supply of electricity to the city of Bahia Blanca. The contract also includes extensive additions to the existing tramway system within the city of Bahia Blanca and several outlying townships. The phenomenal growth of the city and district of Bahia Blanca is mainly due to the enterprise of the Anglo-Argentine Railway Companies. The city possesses one of the most progressive municipalities in South America, and is supported in its prosperity by the unique shipping facilities which it affords to an immense grain-growing tract of country. The present contract had its origin in the taking over by the Buenos Aires and Pacific Railway Co., from a private enterprise of the supply of light and power to the city. The existing plant was found to be inadequate, and a scheme for extensions was projected by Mr. Packenham W. Beatty, the railway company's resident electrical engineer. The designs and specifications for the entire plant have been prepared by Mr. John F. C. Snell, M.I.C.E., the consulting electrical engineer to the Buenos Aires and Pacific Railway Co.

Belfast.—The Tramways and Electrical Committee has accepted the following tenders (the lowest in each case):—

Cast-iron pillars.—Ritchie, Hart & Co.
Railings round electrical station.—Musgrave & Co., Ltd.

Cape Town.—The tender of Messrs. Green & Trevett for the wiring and supply of electric light fittings to a number of houses, guard-room, &c., belonging to the Admiralty, at Simon's Town, has been accepted. The work is being carried out under the supervision of Mr. R. Wightman, electrical engineer to the Admiralty.

Croydon.—The T.C. has accepted the tender of Messrs. J. Jarvis & Sons, Ltd., Hackney Road, London, for coal bunkers, ash conveyor, and receiving hopper at the Electricity Works, at £500.

Glasgow.—The offer of the British Westinghouse Co., Ltd., to supply the Corporation with two rotary converters, with transformers and spares, at £851, has been accepted.

Huddersfield.—Messrs. E. Bould & Son, a local firm, have secured the contract for installing the electric light at the new adult schools at Paddock.

London.—Stepney.—The Council has received the following tenders for the supply of 20,000 pairs of carbons for new arc lamps:—

Gilbert Arc Lamp Co.	(accepted)	£101 6 8
Sloan Electrical Co.		127 10 0

For the supply of 50 tons of moulded pitch, the Council received the following tenders:—

J. Smart & Son	(accepted)	£63 2 6
Brindley & Co.		75 0 0
Do. (alternative)		81 5 0
South Metropolitan Gas Co.		77 10 0
Forbes, Abbot & Lennard, Ltd.		80 12 6
Thomas Crow & Sons		81 5 0

Stoke Newington.—The B.C. received the following tenders for cables to connect the new generating station with the sub-station in Edwards Lane:—

Callender's Cable & Construction Co.		£1,629
W. T. Glover & Co.		1,556
British Insulated & Helsby Cables, Ltd.		1,414
W. T. Henley's Telegraph Works Co.	(accepted)	1,372

The following tenders were received for steam and other pipework at the generating station:—

Babcock & Wilcox, Ltd.	£307
Railway and General Engineering Co.	299
William Freer	279
G. N. Haden & Sons	275
Ashwell & Nesbit, Ltd.	268
John Spencer, Ltd.	(accepted) 265

Hackney.—The B.C. has accepted the tender of W. Cory & Son, Ltd., for 4,000 tons of Cowdenbeath and Edinburgh Washed Pea Nuts, at 10s. 5d. per ton.

L.C.C.—The Fire Brigade Committee have received the following tenders for wiring and fittings for the electric lighting of the engine house block at the chief station:—

Comyn, Ching & Co.	(recom.)	£279	W. J. Fryer & Co.		£299
Tredegar & Co.		286	Lund Bros. & Co.		315
G. E. Taylor & Co.		289			

The Highways Committee have considered the undernoted tenders:—

Reconstruction of Nine Elms-East Hill Tramways.

	Tramway works.	Paving works at street widenings.	Total.
J. Mowlem & Co. ..	£70,673	£19,135	£89,809
Dick, Kerr & Co. ..	71,490	19,158	90,648
W. Manders	73,011	17,996	91,007
J. G. White & Co. ..	78,342	21,612	99,855

Since the tenders were invited, the Committee stated that an arrangement had been made with the Battersea B.C., whereby certain portions of the works in the tramway margins and the reduction of the width of footways would be executed by the B.C., and would therefore be omitted from the contract. By deleting from the above tenders the amounts for the work in question and correcting certain arithmetical errors, the tenders for the tramway works became as follows, the lowest being recommended for acceptance:—

J. Mowlem & Co.	(recom.)	£68,602	W. Manders		£70,097
Dick, Kerr & Co.		68,767	J. G. White & Co.		74,831

Supply of Cable.

L.-R., G.-P., and Telegraph Works Co. ..	(accepted)	£504 (less 2½ per cent.)
W. T. Glover & Co.		570 (less 5 per cent. and 2½ per cent.)
Siemens Bros. & Co.		547 (less 2½ per cent.)
Johnson & Phillips		547 (less 2½ per cent. for cash monthly)
Henley's Telegraph Works Co.		542
Callender's Cable and Construction Co. ..		548
British Insulated and Helsby Cables		551

Southampton.—The following tenders were received by the Education Committee for improved lighting at the York Buildings Boys' School:—

	If completed within 14 days.	If completed within 21 days.
H. Stevens & Co. (accepted at £110) ..	£110 0 0	£105 0 0
Golding & Ansell	113 16 5	108 2 8
Jenkins & Sons, Ltd.	119 0 0	107 0 0
Dyer & Sons	124 10 0	119 10 0
Borough Engineer's protecting tender	150 0 0	130 0 0

Warwick.—The T.C. has accepted the tender of the Leamington and Warwick Electrical Co. for installing the electric light at the Court House, at £48.

CONTRACTORS' COLUMN.

[The following information is published in the interests of electrical contractors and others who are seeking for openings for new business. Considerable expense is incurred in the production of this column, and every care is taken to ensure that the information is new and accurate, but it will be understood that in a matter where so many correspondents are engaged, and where the amount of information to be handled is very large, this cannot always be guaranteed. If alleged inaccuracies are reported to the Editors, they will be fully investigated.]

ABERDARE (Cwmaman).—New Baptist Church (£600). J. Llewellyn Smith: architect, Aberdare; J. Jones, contractor, Gwawr Cottage, Aberaman.

AMERSHAM.—Houses, Amersham Common, for Kemp & How; Hyde Heath, for H. Kennard; Harewood Road, for G. L. Sutcliffe; Amersham Common, for W. Brunning; Chalfont St. Peter, for E. J. Gee; Amersham Common, for E. J. Clark; Chesham Bois, for Sumner & Co.

ANNFIELD PLAIN (Co. Durham).—Developments for the local Co-operative Society.

ASHTON-IN-MAKERFIELD.—Houses, Downall Green Road, for Alfred Derbyshire; model lodging house (88 beds), Heath Road, for A. O'Hara.

ATHERSTONE.—Conversion of premises in Long Street into offices and stores, for the U.D.C.

AYLESBURY.—Houses, High Bridge Road, for W. Bliss; Southern Estate for P. J. Scott.

BANFFSHIRE.—House, at Maryhill, Monquhitter, Estate of Maryhill. W. L. Duncan, architect, Turriff.

BAWTRY (near Doncaster).—Villa residence. Garside & Pennington, architects, Pontefract.

BECKENHAM.—Three houses, Cromwell Road; Luck Bros., Ltd., builders. Two houses, Tudor Road; W. J. Norris, builder, 10, Sidney Road, Beckenham.

BEDLINOG.—Fifteen houses for the South Wales Estates Co., Ltd. Wm. Dowdeswell, architect, Treharris.

BEXHILL-ON-SEA.—Bungalow residence, Popp's Farm, for F. W. Green; J. B. Wall, architect, 18, Devonshire Road, Bexhill.

BLACKBURN.—New Congregational Church in the Four Lanes End district (£3,000).

BLACKPOOL.—New sewage works contemplated. Shop extensions, Church Street, for Messrs. Donnelly.

BOLTON.—New rooms for lunatics at Workhouse, Board of Guardians; new car-shed, S. Parker, town clerk, Bolton; sixteen houses, Moreland Grove, for G. Hargreaves; three new libraries, borough engineer; development of Doffcocker Estate, J. Boyle.

BOURNEMOUTH.—Extension of the pier and landing stage for the T.C. (£9,973). Goddard, Massey & Warner, Ltd., contractors, Nottingham. New St. Alban's Church, now building, in the Charminster Road district (£9,000).

BOWLAND (Lancs.).—New sewage scheme proposed. Surveyor, Bolton-by-Bowland Council Offices, Lancs.

BRADFORD.—Conversion of Bolton House, Peel Park, into School for the Blind City architect, Whittaker Buildings, Brewery Street, Bradford.

BRIGHTON.—Extensive additions to the works of the London, Brighton and South Coast Railway Co., with electrical equipment.

BRISTOL.—Alterations to business premises, Market Gate, High Street, for Messrs. Lennards, Ltd., boot manufacturers.

BROMLEY.—Additions to 26, Shortlands Road, Shortlands; J. R. MacCullum. Alterations to Lyric Theatre; F. J. Ronald, surveyor, 72, Victoria Street, S.W. Houses, Union Road, for F. G. Crickett; Waldegrave Road, for Thompson & Walford.

BURSLEM.—New central school in Moorland Road. A. R. Wood, architect, Burslem.

BUDE.—Shop; P. Bolt, Queen Street, Bude.

BURNHAM (Somerset).—Houses, Rectory Road, for Mrs. Pitts and A. G. Pitts.

BURNLEY.—Houses, Athletic Street. Hitchon & Pritchard, architects, 46, Manchester Road, Burnley.

BURTON-ON-TRENT.—Proposed new premises at Stapenhill, for the Co-operative Society; prospective restoration, after fire, of maltings, for Ind, Coope & Co.

CADISHEAD (near Manchester).—Billiard room, Lord Street, for H. Unsworth.

CAMBORNE.—Houses, Mount Pleasant Road, for Mr. Lean; Eny's Road, for J. Kendall; Wheal Gerry, for Mr. Butler.

CAMBUSBARRON (Stirling).—New "Bruce Memorial" Church (£1,000).

CARDIFF.—Extensions to laundry at Workhouse; E. Seward, architect, Cardiff. Alterations to three houses and erection of warehouse for Cardiff Pure Ice Co.; E. W. M. Corbett, Bute Estate Offices, Cardiff. New mission hall, Plasnewydd Road; G. Hallett, architect, Cardiff. Eight houses in Westville Road, for Geo. Partridge; W. H. Scott, architect, Cardiff. Three houses in Waterloo Road, for J. Comley; W. H. Scott, architect.

CARLISLE.—Shop, offices and warehouse, Lonsdale Street, for C. K. Coulthard; Matthew Johnstone, architect.

CHATHAM.—Three houses, Rainham Road, for F. Wickham.

CHESTERFIELD.—Housing scheme contemplated. Local Co-operative Society.

COLWALL (Worcestershire).—Additions to house. W. Wickham.

CREWE.—Proposed new United Methodist Church at Edleston Road.

CUDWORTH.—Two houses and shops, and three houses in Pontefract Road. Geo. Moxon, architect, Central Chambers, 26, Church Street, Barnsley.

DARTFORD.—Conversion of premises, Lowfield Street, into house, for G. Williams.

DENTON.—Houses, Peel Street, for G. F. Saxton; Vaudrey Lane, for Joseph Redfern; Booth Street, St. John's Road, for Charles Rippingham.

DEWSBURY.—Extensions to the Dewsbury and District Infirmary (£1,700) A. H. Kirk, architect.

DINNINGTON (near Rotherham).—Houses, Lodge Farm, for Rev. G. M. Athorpe; Rotherham Road, for W. J. Holmes, Rotherham; Lorden's Hill, for Carr & Co.; house and club, for Mr. Clayton; additions to property, Laughton Road, for Mr. Fisher, Firbeck.

DONCASTER.—Parish room. E. H. Walker, architect, Doncaster.

DUDLEY.—Proposed new school at Pensnett; J. Hutchings, architect to the Staffordshire Education Committee, Stafford.

DUNDEE.—Proposed home for stray dogs and cats. James Thompson, city engineer.

DURHAM.—New colliery at the Bent House for the Harton Coal Co. (electric power to be used). Houses, Anton Stile, for Gabriel Inness; Shadforth, for Lambton Collieries, Ltd.; Sherburn, for Harle Nicholson; Neville's Cross, for James Cox; Anton Stile, for Henry Meredith; shop and motor garage, Framwellgate Moor, for Charles Smith; store and stables, Framwellgate Moor, for James Calder & Co.

EGREMONT.—Houses, Liscard Road. R. Evans, builder, Hothfield Road, Egremont.

EPSOM.—Houses, Albert Road, for Moxham & Brown.

FARNBOROUGH.—Additions to the Baptist Chapel, High View; house, Union Street, for B. Brown; house and shops, Lynchford Road, for G. Hatts; house, Ashley Road, for V. Wynn.

FARNBOROUGH (Hants.).—Proposed Council school at North Farnborough. W. J. Taylor, architect, The Castle, Winchester.

FENNY STRATFORD.—House, Tavistock Street, for Mr. Howard.

FERRYHILL (Co. Durham).—Two houses, Church Lane, for the N. E. Breweries, Ltd. T. H. Murray, architect, Consett.

FOLKESTONE.—Building in Mount Street for Alderman West.

FRINTON-ON-SEA.—Two semi-detached houses, Queen's Road, for H. A. Bedford; additions to "The Willows" for H. Potts.

GLASGOW.—Alterations and additions to works in Baltic Street, for Sir Wm. Arrol & Co., Ltd., Dalmarnock Iron Works, Bridgeton. Buildings at Aikenhead and Calder Roads, for the North British Locomotive Co., Ltd., Hyde Park Works, Springburn. Eight houses, Mount Florida; R. Henderson, architect, Mount Annan Drive, Mount Florida. Buildings in Carlton Place, for W. Rankin & Sons, 10, Carlton Place. Dwelling houses at Edgefauld Terrace, Springburn, for Annie More (or Gibbs), 2, Syriam Terrace, Springburn. District Library, Queen's Park, for Glasgow Corporation. Proposed smallpox hospital, at Darnley; Ex-Bailie Nicol, Pollokshaws, Glasgow.

GOLCAR (Yorks.).—Two houses, Long Croft Road. Arthur Shaw, architect, Golcar.

GOSPORT.—New schools, Hardway (£4,667). J. Hunt, builder, Gosport.

GOWERTON (Glam.).—Houses for James Kneath, and Messrs. Wm. Evans and D. Davies.

GRAVESEND.—Additions to St. John's Roman Catholic Schools; G. Clay, architect, King Street, Gravesend. Proposed erection of Paper Mills, by Amalgamated Press, Ltd., 23, Bouverie Street, E.C.

GREENCASTLE (Belfast).—New factory for the Jennymount Co., Belfast.

GUISELEY (Leeds).—Twelve houses at Park Gate for the Rev. Sir Peile Thompson, Bart.; H. Chippindale, architect, Guiseley.

HAMPTON.—Alterations to Jenny Lind beerhouse, High Street, Hampton Hill.

HARPENDEN.—Houses, Moreton End Lane, for Rev. A. G. Bowling; alterations and additions to Westlands, Milton Road, for Dr. Hugh Frazer.

HARROGATE.—New St. Mary's Church and Parish Room in Cold Bath Road, for the Rev. J. I. Cohen, vicar of St. Mary's; A. A. Gibson, architect.

HEMEL HEMPSTEAD.—Houses, Redbourn Road, for E. Mead; Belswains Lane, for T. C. Gold; Kingsland Road, for W. Cater.

HEREFORD.—Proposed new rectory and improvements at St. Nicholas Church. Rev. A. B. Wynne Wilson.

HEYWOOD.—Garage in Rochdale Road. Dr. Geddes.

HITCHIN.—Houses, King's Road and Bearton Road, for James Knight.

HORBURY JUNCTION (near Wakefield).—Four houses, Industrial Street. W. & D. Thornton, architects, Bond Street, Dewsbury.

HULL.—Isolation hospital at the workhouse, Beverley Road, for the Sculcoates Union; T. B. Atkinson, architect, 11, Trinity House Lane, Hull.

ILFORD.—Twenty-three houses, Cowley Road; W. Banks, builder, Egerton Road, Greenwich, S.E. Alterations, 3, Blythswood Gardens, High Road; E. T. Dunn, architect, 7, Roding Street, Ilford. Six houses, Montreale Road; J. Patient, 21, Lee Street, Limehouse. Four houses, Wanstead Park Road; Griggs & Son, builders, 71, Manchester Road, E.

INCE.—Houses, Christopher Street, for W. Darbishire; Careless Lane, for E. Fellowes; off Manchester Road, for Henry Mitchell; Victoria Road, Platt Bridge, for Thos. Woods.

IRLAM (Lancs.).—Four houses, junction of Liverpool Road and Station Approach, for Mrs. Yarwood; 10 houses, for R. Clayton; 20 houses in Occupation Road, for Mr. Mullins.

KENDAL.—House, Under Knott, for Mrs. Harrison and Miss Farrer. H. T. Fowler, architect, 6, Cornwallis Street, Barrow-in-Furness.

KEYINGHAM (near Hull).—New Primitive Methodist Church.

KINGSWOOD (near Bristol).—House. La Trobe & Weston, architects, 44, Corn Street, Bristol.

KIRKHAM (Lancs.).—New Post Office and new Fire Brigade Station. Surveyor, Council Offices, Kirkham.

KIVETON PARK (near Sheffield).—Four houses, Doe Quarry Lane, for Pardoe & Robinson.

LEICESTER.—Proposed new church for St. Philip's Parish (£7,000); new church for Holy Trinity Parish, Hinckley (£7,000).

(Hinckley).—Public Baths in Station Road (£2,650). E. H. Crump, Surveyor to the U.D.C., Council Offices, Station Road, Hinckley.

LINTHWAITE.—Houses, Jovil, for Wm. Livesey; Cowlersley Lane, for Chas. Livesey.

LIVERPOOL (West Derby).—Additional buildings at Alder Hey, for the Guardians of West Derby.

LLANDUDNO.—Two houses, St. David's Road. David Davies, Eden Cottage, owner and builder.

LLANELLY.—Proposed cottage homes at Llanerch, for the Board of Guardians.

LLANSAMLET (Glam.).—New Calvinistic Methodist Church; Rees Llewellyn, architect, Birchgrove; D. W. Rosser, builder, Llansamlet. House, for Owen Jenkins.

LONDON.—(Anerley, S.E.).—Class rooms at the District School. Clerk to the Board of Management, North Surrey District Schools, Anerley, S.E.

(Battersea, S.W.).—Divisional offices at St. John's Hill, for the L.C.C. Superintendent architect to the L.C.C., Spring Gardens, S.W.

(Bow, E.).—Extension of Malmesbury Road School (£12,000); L.C.C. Education Architect, Education Offices, Victoria Embankment, W.C. Factory for Bryant & May, Ltd.; Holman and Goodrham, architects, 6, King's Bench Walk, Temple, E.C. Additions to factory in Bmeed Road; E. C. Beaumont, architect, 78, Fleet Street, E.C. Buildings in Blondin Street; F. R. Hasluck, architect, 23, Bush Lane, E.C.

(Lee, S.E.).—Formation of new street at Manor Lane. G. A. Lansdown, architect, 9, Regent Street, S.W.

(Lewisham, S.E.).—Addition to Northbrooke Schools, Hedgley Street. A. H. R. Tenison, architect, 21, Great Peter Street, Westminster, S.W.

(Forest Hill, S.E.).—Buildings in Dartmouth Road, for the London and South-Western Bank, Ltd., 168, Fenchurch Street, E.C.

(Westminster, S.W.).—Buildings near Broad Sanctuary, for the Middlesex C.C.; Sir R. Nicholson, Middlesex Guildhall, Broad Sanctuary, S.W. Building in Prince's Street; H. C. Clarke, architect, 63, Bishopsgate Street Within, E.C.

(Rotherhithe, S.E.).—Vat house at the Vinegar Brewery, Church Street. J. M. Kennard, architect, 13, Railway Approach, London Bridge, E.C.

(Poplar, E.).—Additions to Stour Wharf, Stour Road, for Henry Thomson. Mortuary and Coroner's Court in High Street; Superintendent Architect, L.C.C. Offices, Spring Gardens, S.W.

(South Kensington, S.W.).—Building in Allen Street. P. Hoffmann, architect, 62, New Broad Street, E.C.

(East Ham, E.).—Twenty-four houses and three shops and houses, Mitcham Road, High Street South; W. H. Allerton, "Carisbrook," Wanstead. Bakehouse, for Walkling, baker, 245, High Street.

(Hampstead, N.W.).—Buildings at rear of 22 and 23, New End; J. D. Hunter, architect, 305, Finchley Road, N.W. Additions to No. 1, College Terrace; H. R. Bence & Son, builders, 35, Winchester Road, Hampstead, N.W.

(Shoreditch, N.E.).—Prospective partial restoration, after fire, of premises in Charlotte Street, occupied by Sternberg, Wilson and Co., office furniture manufacturers.

(Tottenham, N.).—Extension of nine houses, Fairview Road; Walters & Hoare, care of E. Evans, 253, Lavender Hill, S.W. Thirteen houses, Antill Road; P. L. Wilson & Co., Ltd., builders, High Road, Lower Tottenham. Seven houses, Rosebury Avenue and Shelbourne Road; G. W. Rowley, builder, 278, Phillip Lane, N.

(Streatham, S.W.).—Building in Mitcham Lane. H. Branch, architect, 25, Cheapside, E.C.

(Whitechapel, E.).—Rebuilding No. 2, Fashion Street. E. Greenop, architect, Falcon Court, Fleet Street, E.C.

(Woolwich, S.E.).—House at Keightley's Farm, Southwood Road. Hodgkinson & Son, architects, 22, Wellington Street, W.C.

(Southwark, S.E.).—Clergy house and other parochial buildings in King's Bench Walk and adjoining streets. Rev. T. Gerard Tyler, vicar of St. Alphege, Southwark.

LONDON (Hoxton, N.E.).—Working-class dwellings on site abutting upon City Road, Catherine Street, Staff Street and Old Street. E. C. P. Monson, architect, 182, High Street, Acton.

(Southwark, S.E.).—King's Hall Palace of Dancing, junction of St. George's Market and Dantzic Street. W. F. Hurndall, dancing master, 84, Blackfriars Road, S.E.

(Holborn, W.C.).—Building in Gate Street, Lincoln's Inn Fields. Barlow & Roberts, builders, 15, Redcross Street, E.C.

(E.).—Mission house for the Jewish Presbyterian Mission Committee (£5,000).

(S.W.).—Thirty-three houses, Southfields. Woodley Bros., builders Woodhouse, Wimbledon Road, Tooting Graveney, S.W.

(Highgate, N.).—Seventeen houses, Southwood Lawn Road. A. G. Shearing, builder, Falkland Road, Kentish Town, N.W.

(E.C.).—Bank, restaurant, shops and offices on sites of Nos. 21, 22 and 23, New Bridge Street. Palgrave & Co., architects, 28, Victoria Street, S.W.

(Kingsland, N.E.).—Alterations and additions to premises in Bradbury Street. C. Castle & Son, builders, Milton Works, Shacklewell Lane, N.E.

(Willesden, N.W.).—Printing shed and boiler chamber, The Willows, Harlesden Road, for Thos. Illingworth & Co., photographic paper manufacturers, Willesden Junction. Three houses, Hillside, Stonebridge; H. Shaw, architect, 69, Nicholl Road, Willesden. Motor garage for M. Weinburg, 45, Makesbury Road, Willesden. Boiler house for the White Heather Laundry; Mark W. King & Sons, surveyors, 6, Holborn Viaduct, E.C.

(Cricklewood, N.W.).—Five houses, Oxgate Gardens. G. H. Paine, architect, 62, Moorgate Street, E.C.

(S.E.).—31 houses; Norfolk & Prior, architects, 4, Station Buildings, Catford Bridge, S.E. Five houses; W. J. Scudamore & Sons, builders, 13, Manor Lane, S.E.

(Bermondsey, S.E.).—Steel shed, Rotherhithe Street, for H. J. Enthoven & Sons, Leadenhall Street, E.C.

(Brixton, S.W.).—Additions, &c., at St. John's Parochial Hall.

(Paddington, W.).—Proposed music hall on site of 68, 68A and 68B, Harrow Road (accommodation for 2,420) to be known as the Paddington Empire, for A. Heyes.

(Hackney, N.E.).—Mission hall, Mabley Street. James Watt, builder, Bromley Road, Catford, S.E.

(Newington, S.E.).—Buildings in New Kent Road. J. S. Lee and Son, surveyors, 35, Craven Street, Strand, W.C.

(Oxford Street, W.).—Rebuilding shops, showrooms, &c., No. 522. Hall, Buddall & Co., builders, Pitfield Wharf, Waterloo Bridge, S.E.

(Harcourt Street, W.).—Workshops, &c. E. W. Coldwell, architect, 7, Southampton Street, W.C. Meech & Goodall, builders, Streatham Hill.

(Camberwell, S.E.).—Buildings in Azenby Square. Deakin and Cameron, architects, 16, Devonshire Square, E.C.

(Deptford, S.E.).—Additions to 82, Kender Street. Purvis & Purvis, architects, 14, Deptford Bridge, Deptford, S.E.

(Pimlico, S.W.).—Buildings, Pimlico Wharf, 145, Grosvenor Road, for Allen & Co.

(Queen Anne's Gate, S.W.).—Building. Blow & Billery, architects, 3, Pall Mall East, S.W.

(E.C.).—Building at 71, Old Broad Street. Joseph & Smithem, architects, 83, Queen Street, E.C.; G. Trollope & Colls, Ltd., builders, 77, Grosvenor Road, S.W.

(E.).—Alterations, &c., at premises of Spratt's Patent, Ltd., Morris Road. Max Clarke & Garbutt, architects, 4, Queen's Square, Bloomsbury.

(W.).—Shop at Knightsbridge Green. C. H. Townsend, architect, 32, Great George Street, S.W.

(St. Pancras, N.W.).—Buildings, Mabledon Place, near Euston Road. W. C. Jones, architect, 32, Bedford Row, W.C.

(N.).—New St. Albans Roman Catholic Church, North Finchley (£5,000). Lamb & North, architects.

LONGHOR (Glam.).—Houses for M. J. Thomas, Thomas & Griffiths and Wilson & Co.

LUTON.—Extensions at cocoa works. Co-operative Wholesale Society, Ltd., Manchester.

MACCLESFIELD.—Extensions to Parkside Asylum, for Cheshire C.C. (£25,000).

MARGAM (Port Talbot).—Houses, Bryn, for T. Jenkins; Bryn, for David and Howell.

MARGATE.—Master's residence, Deaf and Dumb Asylum; F. Windsor, architect. Houses, Lyndhurst Avenue, for F. Ward; Grange Road, for S. J. Pitman, 12, Caroline Square.

MATLOCK BATH.—Pavilion for the U.D.C. (£8,000 to £10,000); new United Methodist Church at Matlock.

MENSTON (Leeds).—Villa residence, for Dr. J. W. Hyslop. H. Chippindale, architect, Guiseley.

MERTHYR TYDFIL.—Houses, near the Goitre, for J. T. Vaughan.

MILNROW (near Rochdale).—Extensions to Belfield Mills, for the Birch Mills Co., Ltd.

MURTON (Co. Durham).—Boiler-house, engine-house, &c., at North Dalton Pumping Station, for the Sunderland and South Shields Water Co. B. E. Blackburn, engineer, 29, John Street, Sunderland.

NAIRN.—New Free Church in Gordon Street. J. Strang, architect, Falkirk.

NANTWICH.—New Council school, Beam Street (£10,000). H. H. Brown, 17, Dickinson Street, Manchester.

(Audlem).—Alterations to Audlem Church schools (£300).

NEWCASTLE-UNDER-LYME.—New Baptist church.

NEW MALDEN (Surrey).—New Post Office in Coombe Road. District Council.

NUNEATON.—New Council school at Chilvers Coton (780 children). E. E. Shepherd, architect, Nuneaton.

OLDHAM.—Thirty-eight houses, Hollin Hall Estate, for the Equitable Co-operative Society. Walter Foster & Son, builders, Greenfield, Oldham.

OXFORD.—Residences on the Magdalen College estate at Headington. Messrs. Harrison, architects, Oxford.

PENDLEBURY.—Additions to Bridgewater Spinning Mills; four houses, Langley Road, T. Cunningham.

PENISTONE (near Sheffield).—House, Clarel Street, for G. Crapper.

PLYMOUTH.—Gunners' residence and officers' rooms at Trevol Range, for the Admiralty. Lapthorn & Co., builders, 1, Clarendon Place, Plymouth.

POOLE.—Waterworks buildings for the T.C. (£4,378). Baker & Pearcey, builders, Parkstone, Dorset.

PRESTON.—New Wesleyan Church in Tennyson Road. E. J. Andrew, architect, Preston.

RADCLIFFE.—One hundred houses in Black Lane and Radcliffe Hall districts. Surveyor, Council Offices, Radcliffe.

REDDITCH.—New school under contemplation. Worcester Education Committee.

RIPLEY.—Probable re-erection (after fire) of Cycle Works, for Arthur King.

ROCHDALE.—New church for St. Mary's Parish (£11,000).

ROCHESTER.—Wharf, Common Creek, for the T.C. (£1,874). Leggott and Speight, contractors, Hull.

RUAN ENNIS (Co. Clare).—New church, for the Rev. J. Garry. O'Malley and O'Rourke, architects, 10, Glentworth Street, Limerick.

RUGBY.—Public baths in Moat Street (£4,200); Borough Surveyor. House and shop, corner of Manor Road and Alexandra Road, for C. J. Newman; motor house at the lamp factory, Lower Hillmorton Road, for J. Findlay; additions to buildings, Mill Road, for the British Thomson-Houston Co.

(Crick).—Sanatorium for consumptives. Crick R.D.C.

ST. HELENS.—Houses, Robin's Lane, for W. Bate; additions to laundry, Blackbrook Road, for the Lady Superior. Ladies' and gents' underground conveniences, and market inspector's office, for the T.C. G. J. C. Broom, Borough Engineer, Town Hall, St. Helens.

SHEFFIELD.—Conversion of Ebenezer Wesleyan Methodist Church Schools into club rooms (£800); new St. Helen's Church at Grindleford Bridge.

SIDCUP.—Bank premises, for the London and Provincial Bank, Ltd. F. T. W. Goldsmith, architect. 1, Verulam Buildings, London; Thos. Knight, builder, Craybrooke House, Sidcup Hill, Sidcup.

SLAITHWAITE (Yorks.).—Ten houses, Hill Top, for John Jagger.

SLOUGH.—Houses, Wexham Road, for Mr. Woolsey; King Edward Street, for N. Groves; Upton Road, for Burfoot & Butler; stable and store, for H. S. Webber, 150, High Street.

SMETHWICK.—Technical School (£14,585). G. Webb & Sons, builders, Handsworth.

SOUTHAMPTON.—House, Foundry Lane, and iron building, Thornbury Avenue; Weston & Burnett, architects, 24, Portland Street, Southampton. Four houses, Richville Road; L. G. Duncan, architect, 10 Hanover Buildings, Southampton. Six houses, King Edward's Avenue; C. G. Osman, builder, Winkfield Row, Bracknell, Berks. Additions to 133, Clifford Street, and motor-car house, Oakdene, Welbeck Avenue; C. H. Brightiff, architect, 13, Portland Terrace, Southampton. House, Cobbett Road; A. Ford, architect, 11, High Street, Portsmouth.

STAFFORD.—Extension of warehouses, for the T.C.; C. J. Nevitt, Ltd., builders, Burley Street, Stafford. Houses, Christopher Terrace, for A. W. Ancill; Henry Street, for H. J. Clay, builder, 158, Sandon Road; Oxford Chambers, for W. Skelthorne, builder, Gaol Road; alterations and additions to premises, 52, Greengate Street, for Messrs. Brookfields, drapers, &c.

STAMFORD.—Nurses' Home, &c., at the Infirmary. Roberts Bros., builders, Stamford.

STANDISH (near Wigan).—Houses, Bradley Lane, for J. Gray; Broomfield Estate, for R. Baxter; Collingwood Street, for John Cheetham.

STRATFORD-ON-AVON.—Proposed municipal housing scheme (103 houses, £20,000).

STROUD (Glos.).—New works for R. Townsend & Co.; Orchard & Pear, builders, Bowbridge, Stroud. Premises in Horns Road, for the Co-operative Society; G. P. Milnes, architect, Rowcroft, Stroud.

SUDBURY.—Probable re-erection of Chilton Lodge (after fire); the Misses Cook, owners.

SURBITON.—Sewerage scheme for the U.D.C. Johnson Bros., contractors, Hereford.

SUTTON.—Houses, Manor Park Road, for W. Lockett; Devonshire Road, for E. J. Hawkins.

SUTTON-IN-ASHFIELD.—Houses, Charles Street, for John Shore; Stoneyford Lane, for Mr. Stendall; Regent Street, for A. Shaw; Glen Street, for Wm. Roberts; Regent Street, for John Keeling; Alfreton Road, for T. Day.

SWADLINCOTE.—House and shop, Regent Street, Gresley, for J. T. Evans; houses, Midway Road, for Ben Warren; Sunnyside, Newhall, for James Rodgers.

SWANAGE.—Houses, Durlston Road, for L. P. D. Way; Priest's Way, for F. W. Pond; four shops, High Street, for Parsons & Hayter.

SWANSEA.—Corporation housing scheme; Pye & Parkinson, builders. Houses at Bonymaen, for Geo. Slade; Pforestfach, for D. Thomas, John Thomas and Wm. Davies; Bonymaen, for Wm. Evans and D. Davies; Graigfawr, for Wm. Richards.

SWINTON (near Manchester).—Six houses, Moss Lane, Swinton. W. Brown.

TAUNTON.—New fire brigade station. D. Edwards, borough surveyor. Residences, Bishop's Hull. P. H. Brown, Taunton.

TEDDINGTON.—Shop and dairy, Kingston Road. Pyke Bros., cowkeepers, 37, High Street.

THAMES DITTON.—E.L. to be installed at the sewage works for the U.D.C.

THIRSK.—New post office in the Market Place. W. Jackson, contractor, Thirsk.

THORNTON (Lancs.).—Lighting scheme in parish church.

TONGE.—Waiting rooms and lavatories in Tonge Manor Road. District Committee.

TONYREFAIL (Glam.).—Residence for Dr. D. N. Morgan. W. M. Lewis and T. N. Morgan, architects, Pontypridd.

TORQUAY.—E.L. to be installed in the chancel and organ chamber of Upton Church.

TREDEGAR.—Isolation Hospital, for the Bedwellty Guardians.

ULVERSTON.—House at Kirkby, for W. S. Satterthwaite; motor-house and stables, at High Cunsey, for R. Goodwin; alterations and additions to "Tower Wood," Cartmell Fell.

VENTNOR (Isle of Wight).—House, Steephill Cove, for Miss Blake; T. R. Saunders, architect, Belgrave Road, Ventnor. Conversion of premises into flats, for Mitchell, Son & Soutter. House, York Road, Lowtherville, for Geo. Childs.

WALKDEN.—Proposed extension of Liberal Club premises. J. T. Proffitt, architect, Walkden.

WALLSEND-ON-TYNE.—Proposed new secondary school. Wallsend Education Committee.

WALTON-LE-DALE (near Preston).—Memorial Hall at Lostock Hall, for Father Mercer.

WALTON-ON-THE-HILL (near Epsom).—Additions to house, Dean's Lane, for N. F. Whiting.

WARE.—Probable re-construction of premises (after fire) for Allen & Hanbury's, Ltd., manufacturing chemists, London. Four houses, at Puckeridge, for H. Shepherd Cross.

WARWICK.—Extensions to the King's High School for Girls; F. P. Trepess, architect; A. & J. Chaplin, builders, 52, Smith Street, Warwick. Six houses, Linen Street, for Mr. Dunn.

WARSOP (Notts.).—Fourteen houses, Wood Street and Queen Street, for Lev Green; two houses, Carr Lane, for Wm. Lee.

WEST HARTLEPOOL.—Sawmill. Baines & Burton.

WESTHOUGHTON (Lancs.).—Repairing and alteration of Hart Common Church and Rectory, and enlargement of school.

WHITLEY (Northumberland).—Public Shelter at Whitley Links to seat 1,000, and promenade space for 400 persons, for Whitley and Monkseaton U.D.C. (£1,200). A. Whitehorn, Clerk to the U.D.C., Whitley Bay.

WIDNES.—Houses, Muspratt Street, for J. Caldwell; Regent Road, for F. Guy; Peel House Lane, for J. Pedlar.

WILLENHALL (South Staffs.).—New Council school in Albion Street (1,090 children). Graham Balfour, Director of Education, County Education Offices, Stafford.

WILLINGTON (Co. Durham).—Nineteen houses, Park Street, Brancepeth Colliery, for Strakers & Love; six houses, Co-operative Terrace, for the Co-operative Society.

WINSLOW (Bucks).—Two houses, Drayton Parslow, for Lord Carrington.

WOLSINGHAM (Co. Durham).—Conversion of the Leases House, near Walsingham, into a Sanatorium for Women. Stanhope Sanatorium Committee.

WOLVERHAMPTON.—New schools at Graiseley, for the T.C. T. H. Fleeming & Son, architects, 10, Queen Square, Wolverhampton.

WOMBWELL (Yorks.).—Three houses, Rimington Road, for Dr. G. E. Atkins.

YORK.—Four pairs of semi-detached houses, Holgate Gardens Estate, Acomb. J. C. Procter, architect, Cabinet Chambers, Basinghall Street, Leeds; Mr. Birch, builder, York.

FORTHCOMING EVENTS.

To-day's Events (Friday, October 23rd).—At 3.30 p.m. At the National Physical Laboratory, Teddington. Physical Society. Series of demonstrations of work in progress in the Laboratory.

At 7.30 p.m. Midland Hotel, Manchester. Institution of Electrical Engineers (Manchester Local Section). Chairman's address, by Mr. Miles Walker, M.I.E.E. Smoking Concert to follow.

King's Hall, Holborn Restaurant. Electro-Harmonic Society. First concert of the season. (See "Notes" columns last week.)

Saturday, October 24th.—Liverpool and District Electrical Association. Visit to the Manchester Electrical Exhibition; 2.40 p.m. train from Exchange Station.

Tuesday, October 27th.—At 7.30 p.m. At the Municipal School of Technology, Manchester. Institution of Electrical Engineers (Manchester Students' Section). Supper and Smoking Concert.

Wednesday, October 28th.—At 7 p.m. At the University, Leeds. I.E.E. Leeds Local Section. Presidential address by Mr. H. E. Yerbury. Paper by Capt. Gardiner, R.E., on "Electric Signalling on Railways." (Working model and lantern views.)

Friday, October 30th.—At 8 p.m. Institution of Mechanical Engineers. Continued discussion on Mr. J. E. Darbishire's paper on "Repairs, Renewals, Deterioration and Depreciation of Workshop Plant and Machinery."

Saturday, October 31st.—Manchester Electrical Exhibition closes.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

The following orders are issued:—

Monday, October 26th.—"A" Company. Technical drill, 6.30 to 9.30 p.m.
Tuesday, October 27th.—"B" Company. Technical drill, 6.30 to 9.30 p.m.
Thursday, October 29th.—"C" Company. Technical drill, 6.30 to 9.30 p.m.
Friday, October 30th.—"D" Company. Technical drill, 6.30 to 9.30 p.m.
Tuesday, October 27th, and every Tuesday until further orders.—Medical inspection for recruits, 6.30 to 7.30 p.m.

(Signed) J. H. S. Phillips.
Capt. and Acting Adjutant.

NOTES.

International Conference on Electrical Units and Standards.—On Wednesday, October 14th, on the occasion of the visit to the Imperial College of Technology, South Kensington, Prof. Ayrton welcomed the delegates at the Central Technical College, and Prof. Callendar invited them to tea in the Physics Department of the Imperial College. On Thursday, Prof. Dewar invited the delegates to visit the Royal Institution, Albemarle Street, and to see Faraday's apparatus.

On Friday the Lord Mayor entertained the members of the Conference at luncheon at the Mansion House, and on Saturday a number of the members visited Cambridge, and were entertained at luncheon in the Hall of Trinity College. In the afternoon a special congregation was held, and the honorary degree of Doctor of Science was conferred upon Dr. Svante A. Arrhenius, the representative of Sweden and Denmark; Prof. Gabriel Lippmann, of France; Dr. S. W. Stratton, representing the United States; and Prof. Emil Warburg, a representative of Germany.

On Thursday last week the delegates were entertained at dinner at the Ritz Hotel by the British Government; Mr. Winston Churchill presided, and there were present about 120 guests, including Lord Rayleigh, President of the Royal Society and of the Conference, the Rt. Hon. Sydney Buxton, Sir G. H. Murray, Sir Schomburg MacDonnell, Sir A. W. Rücker, Sir W. Ramsay, Sir G. Darwin, Sir W. Huggins, Sir W. Crookes, and many other distinguished men of science and politics.

The loyal toast was proposed by the chairman, who afterwards proposed "The Delegates," referring to the practical objects with which they were assembled. While praising practice, he did not disparage theoretical science, and he thought that scientific men received an inadequate reward for their labours. Whatever else might change, science went on unmoved, built up by a wonderful army, of which every man was always in the van. He cordially welcomed the delegates, and wished them success in their labours.

Prof. Lippmann responded, referring to the fact that this country was the first to establish a complete and coherent system of electrical units and standards, which had since come into universal use. England was, therefore, preeminently qualified to offer hospitality to an International Conference on electrical units, and they were glad of the opportunity of once more returning thanks for the cordial welcome which they had received. They were there for the purpose of establishing international legislation, which he hoped would form an additional bond between the nations.

Prof. Warburg remarked that it was decided at St. Louis that a Conference was necessary, and a small Congress was held at Charlottenburg in 1905 to prepare the way. The differences between the national standards were now very small, but they wished to eliminate them entirely. They were indebted to the British Government for their hospitality and for undertaking the work of organising the Conference, which, he hoped, would prove successful.

Dr. Stratton referred to that day's work of the Conference, which had consisted in discussing two zeros; they were dealing with very small quantities—even two zeros had a significance! One standard it was difficult to follow—the British standard of hospitality. Splendid work had been done at the National Physical Laboratory, the results of which had greatly facilitated the work of the Conference, and fully justified the expenditure on the Laboratory. Money was voted freely for battleships; he hoped the time was coming when more laboratories and fewer battleships would be built. Lastly, Lord Rayleigh proposed "The Health of the Chairman," who briefly replied.

On Monday evening last at the Garden Club, at the Franco-British Exhibition, the Dynamicables gave a dinner in honour of the members of the International Conference on Electrical Units and Standards, and of the International Electrotechnical Commission. Col. R.E. Crompton, R.E., C.B., presided, and among those present were the following:—

Boucherot, Paul, France.
Warburg, Dr. E., Germany.
Mailloux, C. O., U.S.A.
Lippmann, Dr., France.
Arrhenius, Prof. S. A., Sweden.
Clément, M., Belgium.
David, Ch., France.
Landry, Dr. J., Switzerland.
Stratton, Dr. S. W., U.S.A.
O'Meara, Major W. A. J., C.M.G., Great Britain.
Roa, Jorge, Colombia.
Simpson, M. G., India.
Ross, Dr. E. B., U.S.A.
Eastman, V., Chile.
Gray, R. Kaye, Great Britain.
Higman, O., Canada.
Costello, A., Mexico.
Haga, Dr. H., Netherlands.
Faber, S. A., Denmark.
Collins, M. J., (secretary to Great Britain's delegates).
Harsanyi, Dr., Hungary.
Madariaga, J., M. de, Spain.
Croskey, Max. F., Paraguay.
Budde, Dr. E., Germany.
Carhart, Dr. H. S., U.S.A.
Gavey, Sir John, C.B., Great Britain.
de Nerville, F. G., France.
Weiss, Dr. T.
Jaeger, Prof. W., Germany.
Glazebrook, Dr. R. T., Great Britain.
Edgcumbe, K., Great Britain.
Larsen, Prof. A., Denmark.
Gaster, L., Roumania.
Crawley, C. W. S. (secretary to British Delegates).
Kondo, Dr., Shigeru, Japan.
Darley, C. W., Australia.
Asano, Dr. Osuke, Japan.
Duddell, W., F.R.S. (secretary to Great Britain's Delegates).
Chappuis, Dr. P., Switzerland.
Dettmar, G., Germany.
Benôit, I. R., France.
Montenegro, Prof. A., Spain.
Lindeck, Dr., Germany.
Nevares, Celso, Ecuador.

Others present included Messrs. W. M. Mordey, A. L. C. Fell A. A. C. Swinton, W. Worby Beaumont, C. H. W. Biggs, A. H Preece, H. W. Miller, W. B. Esson, R. Belfield, J. H. Rosenthal A. M. Sillar, W. Geipel, T. Callender, G. Sutton, J. E. Kingsbury Martin F. Roberts, H. Alabaster, E. J. Fox, H. Scholey, Ruthven Murray, &c.

Electric Shock Fatalities.—According to the *Edinburgh Evening Dispatch*, on the afternoon of 13th inst., while a roadsman, Samuel Forbes, 32, residing at Cockhill Place, Bothwell Park, was at work in Russells, Ltd., Tannochside Colliery, near Uddingston, he was in the act of running several hutches when they left the rails. He at once made for the signal wire to ring the bell, and was successful, but on his not returning a search was made, when he was found lying at the spot dead. It appears that the electric cable which runs past this point had been out of repair, and the signal wire coming into contact with the exposed live wire, Forbes was instantly killed, all efforts to restore life proving futile.

According to a Cardiff paper Ivor Harry, a young underground electrician, employed at the South Pit (Powell Duffryn), Bargoed, met his death on Wednesday evening whilst endeavouring to locate a leakage.

On Saturday a lineman in the employ of the Bradford City Corporation, named Arthur Brayshaw, was engaged in fixing a signal cable in Duckworth Lane, when he fell from the top of the repairing motor-wagon, a distance of 15 ft. He alighted on his head, sustaining shocking injuries, and died before reaching the infirmary. It is stated that Brayshaw was an experienced lineman. There were no signs of burning or scorching. The jury returned a verdict of "Accidental death," and recommended the provision of turntables on the top of the wagons.

Tramcar Brakes.—From the October issue of the *Journal* of the Tramways and Light Railways Association we learn that the report of the Special Committee on Brakes, &c., was adopted by the Council of the Association on July 24th. Before the report is made public, a joint meeting of the Association and the Municipal Tramways Association is to be held at Whitehall, S.W., under the presidency of a representative of the Board of Trade, with a view to harmonious recommendations being secured. This meeting is to be held in the forenoon of Friday, October 30th, and until after that date the report is being treated as strictly confidential. The September issue of the Association *Journal* has had to be postponed in consequence of the above, as it is a special number containing the report itself.

International Electrotechnical Commission.—The first meeting of the Council of the above Commission was held at the Medical Hall, Victoria Embankment, on Monday morning. The address of welcome to the foreign delegates was given by the Right Hon. A. J. Balfour, M.P. The following is the list of delegates:—Australia, Mr. C. W. Darley; Brazil, Sr. H. Vascoucellor; Canada, Mr. O. Higman; Denmark, Mr. S. A. Faber and Prof. Absalon Larsen; France, M. Paul Boucherot and M. Ch. David; Germany, Dr. E. Budde and Herr G. Dettmar; Great Britain, Sir John Gavey, C.B., and Prof. Silvanus Thompson; Holland, Prof. Haga; Hungary, Mr. J. Vater; Japan, Dr. O. Asano and Mr. S. Kondo; Mexico, General Don J. M. Perez and Sr. A. Castello; Russia, M. de Châtelain; South Africa, Mr. Lee Murray; Spain, Sr. Madariaga and Sr. Montenegro; Sweden, Prof. Svante Arrhenius.

Sir John Gavey introduced Mr. Balfour, who emphasised the importance of a common language for industrial purposes, but deprecated restrictions upon the free play of the inventive faculty. He had no fear, however, that the work of the Commission would hamper freedom of action. They would work in harmony with the Conference then also sitting in London.

Prof. Elihu Thomson, who was not present, was elected President of the Commission, and Col. Crompton hon. secretary, Mr. Le Maistre being his assistant.

The report of Col. Crompton stated that 10 Electro-Technical Committees had been officially constituted, and were in working order; committees were being formed in six other countries. The Council in committee would deal with matters relating to nomenclature, the metric system, symbols, a provisional standard of light, and regulations for fire insurance for interior electrical wiring. The report was unanimously adopted. The Council as a Committee will discuss these subjects, and report to the second meeting of the Council to-day (Friday).

In the afternoon the delegates paid a visit to the Central Telephone Exchange of the Post Office, and attended a reception by the Postmaster-General at the General Post Office.

On Tuesday a discussion took place with regard to the system proposed by Colonel Crompton for drawing up the glossary of terms and their explanations. It was agreed that the terms should be drawn up with their equivalents as far as possible in the languages of the different Committees, but that the actual definitions should only be in English and not French, and that it should be left to the separate Committees to deal with the publication of the explanations in their particular languages. The question of a provisional standard of light was briefly discussed, but it was found that this matter was not at present in a sufficiently definite form to make it possible that any recommendations could be put forward.

Platinum Ingots Stolen.—On Monday night, from a show-case in the Machinery Hall at the Franco-British Exhibition, there were stolen two ingots of platinum (107 oz. each), which formed part of the exhibit of Messrs. Johnson, Matthey & Co.

Electrical Football League.—To-morrow (Saturday) the following matches will be decided:—County of London Electric *v.* Robertson's Electric Lamps, at the Guards Polo Ground, Southfields. General Electric F.C. *v.* Metropolitan Electric, at Mill Hill Park. Kick off 3.15.

Last week's results:—St. Pancras Electric 0, General Electric 1; Ediswan 0, County of London 4.

Educational Notes.—The *Times* reports that Mr. Jacob Sassoon has offered to the Bombay Government a sum of 10 lacs of rupees (£66,666) towards the creation of a central science institute on modern lines, to be placed near the Bombay University buildings and to be opened to all students. Sir George Clarke has gratefully accepted the offer.

Oxford.—Convocation has passed a decree accepting with grateful appreciation the offer of the Drapers' Company to build for the University a new electrical laboratory at a cost of £22,000 from the plans of Mr. T. G. Jackson, R.A., and to expend a further sum of £1,000 in its equipment. A decree granting a piece of ground, as an addition to the site of the proposed laboratory on the north side of the Museum, has also been passed.

Institution and Lecture Notes.—Tramways and their Development.—At a meeting of the members of the Association of Midland Local Authorities, held at West Bromwich on Wednesday last week, Mr. Alfred Baker, manager of the Birmingham Corporation tramways, read a paper on "Tramway Undertakings and their Development as affecting Local Authorities." At the outset he referred to the remarkable development of tramways during the past 10 years. He claimed that tramways were as essential to the daily lives of the masses as gas, electricity, telephones, or, indeed, any of the great public services, with, perhaps, the one exception of water. He held that no tramway constructed out of public money could be run in the public interest unless it paid its way. On the question of through running, Mr. Baker said that having obtained possession of their tramways, hundreds of thousands of public money was invested in reconstructing them and adapting them for electric traction, and the local authorities, guarding their properties with a jealous eye, erected a kind of "ring fence" round their towns and cities, and said to an owning authority that happened to be within their gates, "Thus far shalt thou come and no farther." Although that attitude was somewhat excusable in the early days, having regard to the strenuous fights many of the municipalities had had to gain possession of their undertakings, yet the public suffered very severely through not being able to obtain through communication. The result had been that many irritable, and in some cases ludicrous, situations had arisen, and still existed. He was happy to say that wiser counsels prevailed nowadays, and many of the tramway owners had settled their differences, much to the advantage of the public. Personally, he never saw the slightest difficulty in settling the question of interconnection, given one condition, namely, that neither party wanted to profit at the expense of the other. The meeting accorded a vote of thanks to Mr. Baker for his paper, which did not elicit any discussion.

Institution of Engineers and Shipbuilders in Scotland.—The Institution notifies that its address is now Elmbank Crescent, Glasgow.

Liverpool and District Electrical Association.—Mr. H. E. O'Brien, of Formby, on 15th inst., delivered his presidential address, when he dealt with the subject of electric traction, track equipment, switchboard control, rolling stock, and overhead lines (transmission), and a comparison between steam train and electric train working An interesting discussion ensued.

Manchester Association of Engineers.—The "Constantine" Gold Medal, which is annually presented for the best paper read during the session, has been awarded by the Council of the Association to Mr. S. L. Pearce, for his paper on "Steam Turbine Engineering," of which we gave an abstract in our issue of April 10th, 1908.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Electricity works employés are a plucky lot of fellows, if we are to judge from a number of cases of heroism that have reached us within the last six months. Our generating stations to be efficient have to be near a plentiful supply of condensing water; if this be derived from a river or canal, where juveniles are wont to perform their ablutions, the station man sometimes has opportunities for making a good catch, and, not being afraid of water, he acquits himself heroically, as being the most natural thing in the world for one whose calling requires that he should ever be ready to apply artificial respiration to his comrades. A week or two ago we recorded the recognition given to a worthy action of an employé at Shoreditch. Now we learn that quite recently, also, the Royal Humane Society has awarded an honorary testimonial inscribed on vellum to James Law, a switchboard attendant at the works of the South Metropolitan Electric Light and Power Co., Ltd., Blackwall Point, "for having on July 23rd, 1908, gone to the rescue of C. Seabrook, who was in imminent danger of drowning in the Thames at East Greenwich, and whose life he gallantly saved." The fact is that Law, immediately he observed the boy fall into the river, without hesitation jumped in, and kept the boy afloat several minutes, both of them being rescued subsequently in an exhausted condition by a waterman. Mr. Law will, we are sure, not only have the testimonial of the Society referred to, which is something to be proud of, but he is also deserving of the congratulations of his *confrères*.

From a copy of the *North China Daily News* just to hand, we learn that on Saturday, July 4th, 1908, at H.B.M Consulate-General, before Sir Pelham L. Warren, K.C.M.G., Consul-General, and afterwards at Holy Trinity Cathedral, Shanghai, the marriage took place of Thomas Henry Unite Aldridge, to Dorothy Clare, third daughter of H. Lacy Fraser, of Streatham Hill, London. A reception was held in the bridegroom's flat in Yuenmingyuen Road, the staircase of which had been prettily decorated with bamboo and fairy electric lights, arranged by the staff of the Municipal Electrical Department. There was a very numerous and handsome display of presents, which included a Japanese silver tea service from the members of the Municipal Council; a silver dessert set from the members of the Electric Committee; a silver salver with inscription from the foreign staff of the Electricity Department, and a silver flower basket from the Chinese members; and silver fruit dishes from Messrs. Preece and Cardew, consulting engineers, London, with whom Mr. Aldridge was connected for some years before going to Shanghai. The honeymoon was spent in Japan.

On Monday last week, in the presence of some members of the staff of the Lowestoft Corporation Electric Light and Tramways Works, Mr. G. A. Bruce, general manager, presented to Mr. W. R. May, the assistant engineer, in the name of the staff, a mahogany knee-hole table, with nest of drawers, and an adjustable electric reading lamp, on the occasion of his marriage.

The Coventry Electricity Committee has acceded to an application from Mr. G. Tough, station superintendent, to be placed in charge of the undertaking for six months, in order to afford him an opportunity of proving his ability to fill the position of manager, vacant by the resignation of Mr. J. A. Jeckell. Mr. Tough has held his present post over 10 years, and, the Committee states, he has proved himself most efficient, having been largely instrumental

in bringing about the economies and reforms which have placed the works costs of the Coventry station among the lowest in the kingdom.

Tramway Officials.—Rawtenstall T.C. has appointed Mr. J. K. North, manager of the Rossendale Valley Tramways Co., as manager of the Corporation tramways until the system is converted to electric traction.

General.—The directors of the Liverpool Overhead Railway Co. has appointed Mr. J. A. Panton, A.M.I.E.E., whose paper on "Rail Corrugations," read before the I.E.E., will be well remembered, to be assistant engineer to the general manager. Mr. Panton was, until his appointment, rolling stock superintendent.

It is announced that Mr. G. A. Touche has been elected chairman of the United Electric Tramways of Monte Video in succession, to the late Mr. William Trotter.

Mr. Walter K. Meldrum, late works manager for Messrs. Meldrum Bros. at their works, Timperley, has joined Messrs. E. Bennis & Co., and becomes their representative for the North-East Coast.

CITY NOTES.

Ferranti, Ltd.

The third annual general meeting was held on Wednesday at Winchester House, Old Broad Street, Mr. A. W. Tait presiding.

The Chairman, in proposing the adoption of the report (see Electrical Review, October 16th, page 665), said he was pleased to say that notwithstanding the keen competition in the industry the business had shown considerable improvement during the year. The trading profit was £31,165, as against £26,282, or an increase of £4,883. Discounts and interests amounted to £1,365, against £569 for the previous year. That increase of £796 was entirely due to the additional working capital which was put into the business through the prior lien issue which was raised last year. The establishment charges were £13,994, against £11,513, or an increase of £2,481. That increase was principally accounted for by the sum of £900 written off in respect of bad debts, being the provision made in respect of amounts owing by another large electrical manufacturing concern which went into liquidation at the beginning of the year. The increase in charges was only, therefore, about £1,600, and the majority of that was on account of increased advertising and selling expenses. That was an expenditure which had to be faced in order to maintain the business of the company, and the directors were satisfied that it had been justified. The interest paid in respect of the prior lien debentures was £567, as against a small charge last year of £19. The charge would naturally be further increased in the current year's account, as the whole amount had now been placed. The directors had considered it advisable to increase the charge in respect to depreciation, and they had charged £5,000 against £3,600 last year—a substantial increase of £1,400. Notwithstanding this increased charge for interest and depreciation against the revenue of the year, the balance carried to the balance-sheet was £3,274, against £2,091, or an increase of £1,183. That balance helped to reduce the previous balance at the debit of the profit and loss account, which now stood at the small amount of £2,136. Turning to the balance-sheet, the item of tools, plant and machinery, showed an increase of £7,668. That expenditure had been necessary to cope with the increased trade which they hoped to get, and he was pleased to say that the expenditure had been justified, and there was every reason to believe that the business had materially benefited. Notwithstanding the continued fall in prices during the year, the company had, by reducing its working costs and increasing its turnover, been able to show better results. It was anticipated that during the year the working costs would be materially reduced. The expenditure on work in hand, showed an increase of practically £5,000 over the previous year, which was due entirely to the increased turnover of the business. Stocks and stores were £1,000 less, thereby showing that no dead stock was allowed to accumulate. Since the close of this year, £1,000 of the prior lien debentures had been called in and cancelled in accordance with the provisions of the trust deed. Sundry creditors showed a decrease of nearly £6,000, and the general reserve fund now stood at £13,850, as against £8,850. He was pleased to say that during the year under review, the meter department had shown excellent progress, and he was hopeful that during the coming year that progress would not only be maintained, but that a further increase would be shown. There now seemed to be a possibility that the manufacturers would come together and stop the ruinous competition which had been going on in that particular article, and he only wished that some method could be devised which would make it apply to the whole industry. The switchboard department had shown further progress during the year, notwithstanding the keen competition which prevailed in that particular class of work. The work which had been turned out by that department had given every satisfaction, and its name for quality never stood higher. The whole industry, however, was passing through a very anxious time, and suffering from particular troubles of its own, in addition to the general depression in trade. It was impossible, therefore, to make any forecast as to the future, but he was pleased to state that the works were well equipped and the managing director and his staff fully appreciated the difficulties which they had to face, and every effort was being made to improve the company's position, notwithstanding the adverse conditions with which they had to contend.

Mr. J. M. Henderson seconded the motion, and the report was adopted.

Electric Supply Corporation, Ltd.

The directors' report for the year ended December 31st, 1907, shows a gross revenue (including the revenue from Totnes and Chelmsford) of £20,960, a marked increase on the total £7,285 for the previous year. The receipts from the working of the Dumbarton Tramway, £3,543, will not appear again as the line has been made over to the new company. As a result of the year's working, £5,456 has been brought into the net revenue account, as compared with £2,786 in the preceding year, an increase of nearly 100 per cent., which the directors consider satisfactory and encouraging for the future. The company has thus earned net profits sufficient to pay the debenture interest, and the interest on temporary loans, while the full dividend of 5 per cent. on the share capital has been paid to the proprietors from the sum received from the guarantors. The Dumbarton Burgh Tramways were completed and opened for traffic on February 20th, 1907. The Bill, referred to in the report last year, authorising a transfer of the Dumbarton Burgh Tramways, and the Dumbarton Shire Tramway order was duly passed by Parliament and received the Royal Assent; in consequence, the new company has taken over the Burgh Tramways from this corporation, and under the terms of the contract is taking its supply of electricity from the corporation's generating station at Dumbarton. The capital for the new Dumbarton Burgh and County Tramways Co. has been fully subscribed, and the extensions of the line are now completed. The entire system, which comprises about 13 miles of tramway, was opened for traffic in July last, and should substantially contribute to the prosperity of this corporation. The Royal Assent was given in July of last year to the Bill promoted by this corporation, referred to in the last report, for vesting in the corporation the various undertakings, and for giving legal sanction to the agreements with the local authorities. Under this Act the Chelmsford and Totnes companies have ceased to exist, and have been merged into the general business of this corporation. The Hendon Electric Lighting Order was excluded from the Bill, as it was deemed advisable to form a separate company to work the order. This has been effected by the formation of the Hendon Electric Supply Co., Ltd., in which this corporation retains a substantial interest. Good progress has already been made, and, as the district is rapidly growing, the directors consider the interest of the corporation in this undertaking a valuable asset. Owing to the pressure of other work, Mr. C. F. Tufnell has retired from the board. Mr. F. R. Reeves, having relinquished the secretaryship, has been appointed to fill the vacancy thus occasioned.

The following generating stations belonging to the company were completed and in working order at December 31st, 1907:—

	Supply commenced.	Lamps connected. (Equiv. to 8 c.p.) 1906.	1907.	Increase. Lamps.	Total increase.
Chelmsford ..	April 14th, 1890	22,510	23,982	1,472	
Jedburgh ..	Dec. 1st, 1903	2,969	3,257	288	
Melrose ..	Jan. 11th, 1904	2,545	2,677	132	
Dalkeith ..	March 5th, 1904	3,796	4,699	903	
Dollar	Mar. 19th, 1904	1,689	1,707	18	
Totnes	May 31st, 1904	2,555	2,825	270	25,902
Exmouth ..	April 10th, 1905	4,742	7,276	2,534	
St. Andrews ..	June 3rd, 1905	7,993	11,861	3,868	
Hitchin ..	April 1st, 1906	2,463	4,144	1,681	
Dumbarton ..	April 13th, 1906	3,478	14,281	10,803	
Falmouth ..	Dec. 7th, 1906	912	4,845	3,933	
		55,662	81,554		

Edison & Swan United Electric Light Co., Ltd.

The directors' report for the year ending June 30th, 1908, states that the net revenue account shows that the sum of £41,313 has been brought forward from profit and loss account. Interest on debenture stocks has absorbed £16,157; £9,000 has been set aside as depreciation on freehold and leasehold property, plant, and tools; £1,506 has been applied in writing down values of stocks. An amount of £5,000 has been added to the reserve fund. The result as shown in the net revenue account is a credit balance of £9,649, to which must be added the sum of £9,543 brought forward from the previous year, thus making a total of £19,193, out of which the directors recommend the payment of a dividend for the year on the "A" shares at the rate of 2½ per cent. (being 2s. 6d. per fully paid "A" share, and 1s. 6d. per part paid "A" share, amounting to £9,587 leaving a sum of £9,606 to be carried forward. During the year £9,980 of this company's debenture stocks have been purchased and cancelled, resulting in a profit of £1,823, in addition to that shown above. This amount has been appropriated as an addition to reserve against stock depreciation. Cost of establishing the business, goodwill, &c., £390,432, has been brought forward at the figure standing in the last balance-sheet. The freehold and leasehold property and plant have also been brought forward at the value stated in the last balance-sheet, with the

addition of the amount expended to June 30th, 1908, less depreciation charged in net revenue account. There has been expended on capital during the year ending June 30th, 1908, £8,148. The shares of the Altrincham Electric Supply, Ltd., have been taken at par, as in previous years. This concern continues to show satisfactory progress, and has paid a dividend at the rate of 7 per cent. on its shares for the year ended December 31st, 1907. Its indebtedness to this company has been reduced during the year by £1,219. The manufacture of metal-filament lamps has been commenced during the year, and promises to yield satisfactory results. Mr. H. Wolfenden and Sir J. W. Swan, D.Sc., F.R.S., retire in rotation, and offer themselves for re-election.

Cleveland and Durham Electric Power, Ltd.

Mr. Charles Emmott presided at the second ordinary general meeting held at Newcastle-on-Tyne on 14th inst., and in moving the adoption of the report (see Electrical Review, October 9th, p. 612), he said that during the year they had obtained an advance, as was shown in the accounts. This was necessitated by the fact that when the company was launched, and subscribers and the public were asked for £700,000, the subscriptions fell short of that amount by rather more than £200,000. Later they had to raise further capital at a time when the money market was probably at its worst. The bankers, however, came to their assistance, and they would be interested to hear that at no time did they pay a higher rate of interest than 5 per cent. On the building and equipment of sub-stations, &c., they had spent during the year about £46,000. Turning to the profit and loss account, they would observe that the revenue of the year had amounted to £73,328, while the expenses, excluding directors' fees and interest, amounted to £56,163. They had hoped that the receipts would have reached a higher figure, in which case the costs would not have gone up proportionately. Unfortunately, in common with almost every other company in the district, their revenue had been most seriously affected by the strikes and trade depression. As they were aware, a large proportion of their revenue was receivable from shipyards and engineering works, and for many months some of their consumers were practically idle and took no current from the company. Others upon whom they had expended capital, putting themselves in a position to supply, could not obtain the motors contracted for, the makers being unable to deliver them. Some consumers had not yet taken a single unit, and others had reduced their demand by 50 per cent. The effect of this on their business had been serious, but it would not permanently change their enterprise. To a less extent the year's trading had suffered owing to the delays on the part of the contractors and others—then again aggravated by the engineers' strike—in completing for commercial service two waste heat stations which they had agreed to operate. Taking all these circumstances into consideration, the directors did not feel that the results for the year were very disappointing. They would observe that £10,000 of the profits had been utilised in writing down preliminary expenses. In dealing with their profits in that way they had consideration, first of all, to their cash requirements. To deal with their new business they would require further capital, and the directors had recently made arrangements for raising such a sum as should, with the cash available, provide sufficient working capital to enable all new business to be dealt with for some time to come. At present every penny was needed in the company's business, and as, moreover, a portion of the profits of the year were derived from work carried out for associated companies, the board were unanimously of opinion that they would be ill-advised to pay the final dividend on the preference shares; instead, they decided to strengthen the position by writing down the preliminary expenses, a course which they believed the shareholders would approve. Referring to the work carried out and business secured during the past 12 months, the chairman said they would be glad to hear that the arrangements for the bulk supply to Blyth, Spennymoor, Hartlepool, and Consett, had been completed during the year. Their mains had been extended to Hartlepool, and in the Cleveland iron mines district, they had pushed out as far as Loftus. The most important work at present in hand was the laying of a cable from the north bank of the River Tees, at Haverton Hill, which ran through the heart of the East Durham coalfield, northwards to join the Durham Power Co.'s system near Murton Colliery. This cable would confer double advantages upon the company for not only would it enable a new source of revenue from colliery supply to be tapped, but it enabled all the surplus current generated at the power station in the Tees district to be transmitted northwards and sold to the Newcastle and Durham companies, with whom already arrangements had been made, and it also afforded an additional source of supply from the northern power stations to the southern power stations in case of emergency. Since the report a year ago, agreements had been closed with Messrs. Bolckow, Vaughan & Co., Messrs. Bell Bros., Ltd., The British Chilled Roll and Engineering Co., Messrs. Pease & Partners, Ltd., Messrs. Cerebos Salt & Co. Ltd., the North-Eastern Railway Co., Messrs. Samuelsons & Co., Ltd. (Spawood Mines), &c. Perhaps the most important development in which the company was engaged was the application of electric driving to rolling mills. They had made arrangements to supply four rolling mills of over 1,000 H.P. each. The electrical operation of these mills would be watched with keen interest by local iron and steel makers, and when once their successful operation had been demonstrated, they anticipated that considerable impetus would be given to that department of the business. He said, in conclusion, that, in spite of serious obstacles, a solid and increasing business was being built up, and by the unceasing labours of capable engineers and management, they might be encouraged to look forward to the time when the undertaking would rank as a satisfactory dividend-paying company, and prove the most potent factor in aiding the industries of the district to maintain and increase their prosperity, and in attracting numerous industries to the territory they served.

The report was seconded and adopted.

Messrs R. W. Armstrong, P. E. Noble, M. L. Bell, and C. Emmott were re-elected directors.

Companies to be Struck Off.—Unless cause is shown to the contrary, the following are to be struck off the register within three months:—

Brunè-Turchi Telegraphonic Co., Ltd.
Corporation for Promoting British Trade Abroad, Ltd.
Electrical Engineering Co. of London, Ltd.
Lancashire Rubber Co., Ltd.
Udabage Plantation Rubber Co., Ltd.

Prospectuses.—*Buenos Ayres Lacroze Tramways Co.*—The Anglo-American Debenture Corporation, Ltd., is offering for sale until Monday next £200,000 5 per cent. first mortgage debenture stock in this company at 96 per cent.

Aluminium Corporation, Ltd.—According to the *Financial Times* the board of this Corporation—in order to provide the necessary funds for past developments and future extensions—has created £150,000 5 per cent. debenture stock, and £102,838 is offered at par to the preference shareholders, in the first instance, in the proportion of £2 stock for every five preference shares held; the remaining £47,162 stock will not be issued without the sanction of a meeting of the preference shareholders.

Stock Exchange Notices.—The Committee have ordered the undermentioned securities to be quoted in the Official List:—

Underground Electric Railways Co. of London, Ltd.—£1,000,000 5 per cent. prior lien bonds, Nos. 1 to 2,500 of £200 and 2,501 to 7,500 of £100 each; £2,800,000 4½ per cent. bonds of 1933, Nos. 1 to 8,000 of £200, 8,001 to 16,500 of £100, and 18,501 to 36,000 of £20 each; and £4,900,000 6 per cent. income bonds, Nos. 1 to 15,000 of £200, 15,001 to 28,000 of £100, 31,001 to 37,000 of £50, and 37,001 to 52,000 of £20 each, in lieu partly of the 5 per cent. Profit-sharing secured notes and deposit receipts for notes now quoted.

Application has been made to the Stock Exchange Committee to appoint a Special Settling Day in—

Marconi's Wireless Telegraph Co., Ltd.—124,908 7 per cent. cumulative participating preference shares of £1 each, fully and partly (10s.) paid, Nos. 500,001 to 624,908; and 172 7 per cent. cumulative participating preference shares of £1 each, fully and partly (5s.) paid, Nos. 624,909 to 625,080.

Calcutta Electric Supply Corporation, Ltd.—The number of units delivered to consumers during the four weeks ended September 25th, 1908, were 632,403, compared with 592,464 units in the corresponding four weeks of 1907.

The directors have declared an interim dividend at the rate of 6½ per cent. per annum for the half-year ended June 30th last on the paid-up ordinary share capital. The dividend will be payable on November 15th.

Cuba Submarine Telegraph Co., Ltd.—The directors' report for the half-year ended June 30th last states that the total receipts of the six months were £18,079, while the expenses amounted to £6,523 10s., leaving a balance of £11,556, to which has to be added £7,000 brought forward, giving a total of £18,556 to be dealt with; £4,000 has been added to the reserve fund, which now stands at £110,000. The dividend on the preference shares will absorb £3,000, and leave £11,556, out of which the directors recommend the payment of a dividend at the rate of 6 per cent. per annum on the ordinary shares, free of income-tax, the balance, £6,756, being carried forward. The cables continue in good working order.

Montreal Light, Heat and Power Co.—The directors announce a dividend of 1½ per cent. on the paid-up capital stock, being at the rate of 6 per cent. per annum for the quarter to 31st inst.

American Telephone and Telegraph Co.—The *Times* states that the company announces that the gross earnings for the nine months ended September 30th, amounted to $20,999,000, against $17,950,000; the net amount after payment of interest being $13,713,000, against $11,147,000; and after payment of the October dividends there was a net surplus of $4,423,000, against $3,254,000.

Yates & Thom, Ltd.—The report for the year ended August 8th, states (says the *Times*) that after providing for depreciation of plant and machinery and interest on the mortgage debenture stock, there remained £23,908. Adding the balance brought forward there was £30,488 available for distribution. The directors, after transferring £5,000 to the reserve fund, recommend a dividend of 7 per cent. on the ordinary shares, leaving £11,238 to carry forward.

Switzerland.—La Société Electro-Metallurgique (procédés Paul Giron), of Neuchatel, is increasing its capital from £250,000 to £500,000.

Belgium.—The balance-sheet of La Société de la Manufacture de Cables, Accumulateurs et Appareils Electriques of Seneffe, for the last financial year, shows a profit of £550.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	Receipts for the fortnight. £*	No. of wks.	Total to date. £	Total to date. £*	Route miles open.	Inc.
Aberdeen	Oct. 14	2,827	+ 70	29	30,384	— 377	14·4	..
Ayr	,, 17	452	+ 32	22	8,690	— 258	8	..
Bath	,, 14	1,668	+ 23	41	30,989	— 2,293	13	..
Belfast	,, 16	7,615	+ 290	29	105,567	+ 1,308	37	..
Birkenhead	,, 18	2,154	+ 39	29	31,480	+ 515	13·52	..
Birmingham Corp.	,, 10	13,192	— 510	28	176,848	— 6,083	56·46	..
†Blackburn	Sept. 2	1,117	— 100	23	27,098	+ 996	14·18	..
Blackpool Corp.	,, 17	3,906	— 839	..	37,178	— 983	11·67	..
,, – Fleetw'd.	Oct. 17	1,152	+ 244	15	18,819	— 1,938	8·25	..
Bolton	,, 18	4,608	+ 531	29	68,842	+ 1,295	26	..
Bournemouth	,, 14	3,185	+ 192	28	51,084	— 2,793	21·72	..
Bradford	,, 10	9 940	+ 446	27	133,765	+ 316	54·9	..
Brighton	,, 18	1,868	+ 151	28	29 257	+ 616	9·5	..
Bristol	,, 16	10,617	+ 508	..	..	..	30·5	..
Brit. Elec. Trac. Co.								
Airdrie	,, 10	473	— 16	40	8,978	+ 9	3·65	..
Barnsley	,, 10	364	+ 11	,,	7,109	+ 396	..	..
Barrow	,, 10	506	— 18	,,	10,122	— 460	5 37	..
Cavehill	,, 10	185	+ 14	,,	3,7 0	+ 169	..	..
Devonport	,, 10	1,039	+ 72	,,	18,871	+ 70	8 85	..
Gateshead	,, 10	2,122	— 6	,,	40,729	+ 162	11 25	..
Gravesend	,, 10	465	— 68	,,	8,700	— 1,371	6·5	..
Greenock	,, 10	1,075	— 337	,,	21,555	— 5,413	7·25	..
Hartlepool	,, 10	514	— 87	,,	9,848	— 2,060	6 72	..
Kidderminster	,, 10	211	— 22	,,	4,656	— 343	..	..
Leamington	,, 10	385	+ 53	,,	6,984	+ 397	3	..
Merthyr	,, 10	457	+ 1	,,	8,565	+ 52	2·9	..
Metropolitan	,, 10	13,115	+9,087	,,	283.166	+40,203	22	..
Middleton	,, 10	731	+ 28	,,	14,740	+ 224	8·5	..
Mid. Joint Com'tee	,, 10	12,094	— 483	,,	262.479	— 4,028	..	..
Oldham—Ashton	,, 10	1,220	— 35	,,	24,082	— 475	9·13	..
Peterborough	,, 10	353	+ 7	,,	5,289	+ 12	5·31	..
Potteries	,, 10	3 561	— 240	,,	72,787	— 1,665	29	..
Rothesay	,, 10	278	— 117	,,	9,375	— 523	2·75	..
Southport	,, 10	602	+ 86	,,	11,792	— 894	8·17	..
S. Metropolitan	,, 10	1,885	+ 222	,,	33,185	+ 282	..	..
Swansea	,, 10	1,973	— 196	,,	38,215	+ 762	12·5	..
Tynemouth	,, 10	488	+ 99	,,	9,694	— 728	3·75	..
Weston-s-Mare	,, 8	243	— 6	,,	6,514	+ 294	3	..
‡Worcester	,, 10	616	— 1	,,	11,610	— 94	5·75	..
Wrexham	,, 10	219	+ 4	,,	4,180	— 14	..	..
Yorks. Wool. Dist.	,, 10	1,992	+ 169	,,	37,161	— 883	17	..
Miscellaneous	,, 10	426	— 18	,,	8,418	— 762	..	..
†Burnley	,, 17	2,392	— 62	..	..	..	7·5	..
Burton-on-Trent	,, 18	573	+ 3	29	8,082	— 589	10	..
Bury	,, 18	2,810	+ 98	28½	35,095	+ 1,974	22·5	..
Cardiff	,, 10	4,371	+ 196	28	62,272	— 160	..	..
Carlisle	,, 17	766	— 15	42	7,440	+ 40	..	..
Chatham and Dist.	,, 15	1,922	+ 479	41	32,599	+ 1,950	14·68	2·14
Cork	,, 15	974	+ 74	41	19,148	— 161	9·89	..
†Croydon	,, 9	1,552	+ 160	28	40,756	— 522	11·25	·75
Darlington	,, 17	384	— 47	29	5,607	— 439	..	..
Darwen	,, 16	515	+ 6	45	7,395	— 154	4·86	..
Dover	,, 10	457	— 3	28	6,922	— 256	4 75	..
Dublin	,, 16	10,782	—1,729	..	88,618	—25,505	54·25	5·5
Dundee	,, 14	3,538	+ 93	21½	26,947	+ 1,500	14·5	..
East Ham	,, 17	1,892	+ 114	29	25,623	— 1,220	8·43	·68
Exeter	,, 2	691	+ 28	27	8,998	— 190	5·5	..
Glasgow	,, 17	26.331	— 263	..	345,708	— 5,347	89·5	·5
Hastings	,, 16	2,243	+ 367	..	..	..	..	..
Huddersfield	,, 17	3,188	..	..	47,479	— 107	28·5	·5
Hull	,, 17	6,347	— 110	29	71,551	— 208	18	..
Ilkeston	,, 14	289	— 6	28	4,195	+ 3	3·5	..
Ipswich	,, 17	799	+ 45	29	12,324	— 265	10·5	..
Kilmarnock	,, 10	909	— 16	21	3,327	— 212	4·21	..
Lan'kshire Trm Co.	,, 15	2 684	+ 129	41	53,341	+ 3,328	17	1·18
Lancashire United	,, 14	2,851	+ 243	41	55,694	+ 2,312	99	1
†Leeds	,, 10	6,735	— 43	25	188,378	+ 3,999	96·72	·25
Leicester	,, 17	4,811	+ 6	..	..	..	..	..
†Leith	,, 10	558	+ 13	21½	11,846	— 12	6	..
Liverpool	,, 10	11,478	— 209	41	438,812	— 9,577	104	..
‡L.C.C.	,, 3	75,467	+9,840	..	942,585	+103,295	121½	..
London United	,, 17	16,103	+1,789	..	283,005	+ 4,457	..	..
†Lowestoft	,, 17	195	..	3	503	— 21	3·5	..
Manchester	,, 17	31,896	+1,888	29	448,222	+11,495	89·5	11
Newcastle	,, 17	7,791	— 585	29	112,997	— 6,874	..	..
Newport	,, 17	1,276	+ 3	29	19,659	— 1,074	14·5	..
†Northampton	,, 10	482	+ 752	27½	13,377	..	5·5	..
Oldham	,, 18	3 713	— 273	29	59,286	+ 182	28·75	..
Pontypridd	,, 10	978	+ 325	28	10,692	+ 3,162	5	1·75
Portsmouth	,, 17	4,024	+ 561	29	62,940	+ 478	14·5	..
Preston	,, 14	1,481	— 15	..	..	..	..	..
†Reading	,, 8	639	+ 3	27½	17,745	+ 180	13·25	..
Rotherham	,, 15	1,260	+ 22	28½	17.617	+ 72	10	·66
Salford	,, 12	9,854	+ 496	28	183,648	+ 2	38·9	..
Sheffield	,, 18	11,197	— 97	29½	166.477	— 1,328	87	1·25
Southampton	,, 14	2,186	+ 136	28	31,899	+ 1,569	..	..
Southend-on-Sea	,, 14	927	+ 222	29	14,656	+ 1,163	..	..
South Shields	,, 10	1,188	+ 86	..	16,240	— 273	..	..
†Swindon	,, 14	146	— 31	..	..	..	4·4	..
Tyneside	,, 14	867	— 86	15	6,537	— 739	8·87	..
Wallasey	,, 17	1,792	+ 204	28½	26.942	+ 1,281	8·72	·22
Walthamstow	,, 17	1,291	+ 175	29	19,746	+ 939	9	..
West Ham	,, 8	4,613	+ 19	27	62,871	— 3,594	14·7	..
Wolverhampton	,, 14	1,720	— 19	28	24,395	— 516	12·5	..
Baker St.-Waterloo	,, 17	6,315	+ 975	16	47,380	+10,080	4·25	1
Cen. London Rly.	,, 17	16,865	+5,699	16	120,104	+41,057	6·32	·55
Char. +, Eus. Hamp.	,, 17	6,835	+1,545	16	52.605	+13,090	7·75	..
City & S. Lon. Rly.	,, 18	6,041	— 239	16	47,637	— 1,071	7·3	1·05
Dublin-Lucan Rly.	,, 16	270	+ 33	15	2,375	— 46	7	..
G.N. and City Rly.	,, 17	2,813	— 617	16	20,920	— 4,783	3·5	..
G.N., P'dy. & Brmtn.	,, 17	10,485	+1,350	16	79,745	+15.865	9·25	·25
L'pool Overh'd Rly.	,, 18	2,688	— 220	16	22,815	— 2,976	6·8	4·3
Mersey Railway	,, 17	3.771	+ 56	16	29,759	+ 575	4·5	..
Metropolitan Rly.	,, 18	34,428	+2,781	16	259,904	+18,756	16	..
Met. District Rly.	,, 17	19.740	+2 910	16	145,120	+24,574	24	..
Anglo-Argentine	,, 14	52,600	+16,645	42½	843.981	+165,152	43	..
§Auckland	,, 9	12,264	+2,150	40½	123,413	+19.525	22·3	3·1
Bombay (B.E.T.)	Sept. 24	4,917	+ 695	38	£0,189	+16,519	..	..
§Brisbane	,, 30	14,490	+1,330	..	..	..	..	..
Calcutta	Oct. 17	5,712	—1,000	..	..	..	..	..
§Geneva	Sept.	9,755	+ 634	..	..	..	..	..
§Kalgoorlie, W.A.	,,	4,326	..	39	35,277	..	20·5	..
Madras	Oct. 15	1,246	+ 89	41	28,585	+ 1,771	12·75	..
†Perth (W.A.)	,, 16	2,553	— 181	42	57,070	— 1,234	25·6	..

* Compared with the corresponding period of 1907. † One week only.
‡ Includes horse, steam and other receipts. § One month.

STOCKS AND SHARES.

Tuesday Afternoon.

News, rumours and alarums from the Near East make up the staple fare of the markets day by day, and with such a state of affairs current, there can be no quietude of public confidence or return of steady business. The apparently aimless way in which the price of Consols wobbles from day to day is a good criterion of the general sentiment. At one moment, the tone is less pessimistic; at the next, less optimistic. Herein lies no encouragement to business.

The Manchester Exhibition, as a factor in the electrical departments, has been of no practical significance.

Electricity Supply shares have been neither disturbed nor elated at the introduction of the Electricity Bill into the House of Commons on Monday evening. There is not sufficient novelty about the proposals to evoke any great amount of interest in them, from the market point of view. They are not likely, on the one hand, to frighten proprietors out of their holdings, but, on the other, they are not calculated to attract investors.

Therefore, movements on the week are even more than ordinarily trifling, and are limited to declines in Westminsters, City of London, Chelsea and Charing Cross Preference. Hove Ordinary shares remain at 6¼, but are *ex* the 4s. dividend.

Fluctuations in the Canadian-Mexican division show a return to firmness in the issues of the Mexican Light and Power Companies. Business is brisk in most of the stocks. As regards the Tramways, Mexico Common has held all its previous week's rise of 13 points to 143, and the 5 per cent. bonds hardened to 94¼. Rio shares regained 1, improving to 65½, and the 5 per cent. bonds are 91¼. United Electric Tramways of Monte Video 5 per cent. First Debenture stock, to which attention was drawn here in the last issue, rose 2 to 102. Havana Electric Fives are also 2 up at 89½.

The hopeful people declare that the small dividends at present being paid on Mexican Tramways Common shares are no guide to the real profits being earned by the company, and prophesy airily enough of distributions that shall range between 10 and 20 per cent. in the future. Such statements are, no doubt, to be modified by a large grain of salt; but unless the company were indeed doing much better than appears from the dividend, the current quotation of 143 for its Common shares would be as unjustifiable as it would be difficult to maintain.

Other Foreign and Colonial Tramway descriptions are mostly firm. Brisbane Electric Tramways Investment Ordinary hardened to 4⅞ and Anglo-Argentines have improved, although the latter company's First Debenture stock lost 2 points.

Prices in the Home Railway market have been fidgety. Swayed first one way and then the other by the Near Eastern news, no settled tendency has developed. The purely Tube stocks are unaltered, but Metropolitan Consolidated fell a point upon fears of competition by L.C.C. tramways. City and South London 4 per cent. Debenture stock looks cheap at 101½, with the 2 per cent. dividend to come off at the end of the month. Bakerloo Debenture stock stands at 94, Great Northern, Piccadilly and Brompton at 93, and Charing Cross, Euston and Hampstead at 86.

Telegraph stocks and shares remain steady, but they display few material changes. Cuba Telegraphs continue their improvement, and West India and Panama Ordinary at ⅝ are 1/16 better. *Ex* dividend markings in the Eastern group has had little effect, and the deductions from Anglo-American telegraphs, for the same reason, were followed by no particular alteration. Globe Preference are ⅛ lower, while Mackay Companies' Common shares gained a couple of points at 72½, the Preferred remaining at 70.

National Telephone Deferred eased off ½. United River Plate Telephone 4½ per cent. Debenture is quoted 104½ to 106½, and other telephone issues kept steady.

Babcock & Wilcox have recovered 1/16 of their last week's recession. Edison & Swan shares are unaffected by the disappointing dividend. Willans & Robinson Ordinary, *ex* 1s., remain about 20s., while the Preference, *ex* 3s., were marked down ¼ to 2⅜ middle.

Cables Damaged by Trawlers. — The report of the Inter-Departmental Committee on injuries to submarine cables recommends that all cable companies should—as certain companies and the Post Office have already done—establish friendly relations with the fishermen who frequent the waters in which their cables are laid, while the fishermen on their part should try to clear their trawls when they foul a cable, and should report the position of any contact with a cable. The Committee also recommends that a system of Government inspection of the gear of trawlers be at once instituted, that steps be taken through the diplomatic channel to invite neighbouring foreign States to adopt a similar system of inspection, and that cable companies should consider the question of substituting heavier types of cable in the areas affected.

SHARE-LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years. 1904.	1905.	1906.	1907.	Closing Quotations Oct. 13th.	Closing Quotations Oct. 20th.	Business done week ended Oct. 20th, 1908. Highest	Lowest.	Rise + or Fall −	Present Yield per cent. £ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	2 — 3	2½ — 2¾	..	..	+ ¼	Nil.
136,700	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	Nil	5 %	5 %	5 %	90 — 93	90 — 93	..	..	..	5 7 6
$131,551,400	American Telephone & Telegraph, Cap. Stock ..	$100	7¼%	7½%	8 %	8 %	129 —133 xd	129 —133	..	..	..	6 0 4
$32,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	92 — 94	92 — 94	94	..	..	4 5 1
598,180	Anglo-American Telegraph	Stock	2¾%	3½%	3¾%	3¾%	58 — 61	58 — 61	58½	58½	..	5 14 9
3,200,910	Do. do. do. 6 % Pref.	Stock	5½%	6 %	6 %	6 %	103½ —104½	102 —103	102½	102	—1½	5 16 6
3,200,910	Do. do. do. Deferred	Stock	Nil	¾%	1¾%	1 %	16⅜ — 17	16⅜ — 17⅛	17	16½	+ ⅛	5 15 11
50,000	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	..	5 %	5 %	5 %	99 —102	99 —102	..	..	..	4 16 2
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	8 %	8 — 8½	8 — 8¼	8 1/16	..	..	4 14 1
2,383,376	Commercial Cable Stlg. 500 year 4 % Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	88 — 90	88 — 90	89½	88½	..	4 8 11
16,000	Cuba Telegraph	10	5 %	5 %	5 %	6 %	7½ — 8½	7⅞ — 8⅜	8¼	..	+ ¼	6 17 2
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	16½ — 17½	16½ — 17½	..	..	+ ½	5 13 6
12,981	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	3 — 3½	3 — 3½	..	..	..	6 9 1
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8 — 9	8 — 9	..	..	..	5 8 1
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	8 14 10
60,710£	Direct United States Cable	20	3½%	4½%	4½%	4½%	13⅜ — 13⅞	13½ —13⅝	13½	13⅜	..	6 2 6
58,700£	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	7 %	136 —139	135 —138	137	126	—1	5 1 5
2,000,000	Do. 8½ % Pref. Stock	100	8½%	8½%	8½%	8½%	85 — 87	84 — 86	85⅝	84¼	—1	4 1 5
1,896,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	103 —105	103 —105	104	103	..	3 16 2
800,000	Eastern Extension, Australasia, and China Tele.	10	7 %	7 %	7 %	7 %	12⅜ — 13½	12⅜ — 13½	13	12 1/16	— ⅛	5 5 8
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	101 —103	101 —103	101½	101½	..	3 17 8
269,700	East & S. Afric. Tel., 4 % Mt. Db., 1 to 8,000, red. 1909	100	4 %	4 %	4 %	4 %	99½ —101½	99½ —101½	..	..	..	3 18 10
200,000£	Do. 4 % Reg. M. Debs. (Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	101½ —103½	101½ —103½	..	..	..	3 17 4
181,127	Globe Telegraph and Trust	10	5⅝%	5½%	5½%	5½%	10⅜ — 11⅛	10⅝ — 11⅛	11	10⅜	..	5 5 8
181,127	Do. do. 6 % Pref...	10	6 %	6 %	6 %	6 %	13⅜ — 14⅛	13½ — 14	13⅝	13½	— ⅛	4 5 9
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	24 %	24%	20 %	20 %	29 — 31	29 — 31	29½	..	..	6 9 0
24,300£	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
17,000	Indo-European Telegraph	25	13 %	13 %	13 %	13 %	56 — 59	56 — 59	57½	..	..	5 6 8
$11,380,400	Mackay Companies Common	$100	1 %	2 %	3½%	4 %	68 — 72	70 — 75	..	..	+3	5 9 7
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	68 — 72	68 — 72	..	..	..	5 9 7
394,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	Nil	⅝ — ⅞	⅝ — ⅞	7/6	..	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	4 %	5 %	6 %	6 %	1 — 1⅛	1 — 1⅛	21/3	..	..	5 6 8
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	5 %	¾ — 1	¾ — 1	..	..	..	5 0 0
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	109 —111	109 —111	110⅜	109	..	5 8 1
3,725,000	Do. do. Def. Stock	100	5 %	5%	5 %	6 %	118 —120	117½ —119½	118⅜	117½	— ½	5 0 6
15,000	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	6 %	10¾ — 11¼	10¾ — 11¼	11	10¾	..	5 6 8
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	5 %	5 %	10¾ — 11¼	10¾ — 11¼	..	..	..	4 8 11
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5⅜ — 5⅝	5⅜ — 5⅝	5⅝	5⅜	..	4 6 11
2,000,000	Do. do. 8½ % Deb. Stock Red.	Stock	3½%	3½%	8½%	3½%	98½ —100½	98 —100	99½	..	— ½	3 10 0
1,716,593	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	102 —104	102 —104	102	..	..	3 16 11
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	6½%	7 %	7 %	8 %	1½ — 1⅝	1½ — 1⅝	..	..	..	5 16 4
50,000	Do. do. do. 6 % Cum. Pref... ..	1	6 %	6 %	6 %	6 %	1 1/16 — 1 1/16	1⅛ — 1½	..	..	— 1/16	4 16 0
99,100	Do. do. do. 4 % Red. Deb. Stock ..	100	..	4 %	4 %	4 %	89 — 92	89 — 92	..	..	..	4 7 0
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	100 —103	100 —103	..	..	..	3 17 8
11,889£	Reuter's	8	5 %	5 %	5 %	5 %	7½ — 8½	7 — 8	..	..	— ½	5 0 0
99,100	Telephone Co. of Egypt, 4½ % Deb. Red.	100	..	4½%	4½%	4½%	99 —102	99 —102	..	..	..	4 8 8
3,083	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	130 —133	127 —130	..	..	—3	4 12 4
100,000	United River Plate Telephone	5	8 %	8 %	8 %	8 %	6⅜ — 6⅞	6⅜ — 7⅛	6⅞	..	..	5 16 4
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5 — 5½	5 — 5½	..	..	..	4 10 11
80,008	W. Coast of America, 1 to 80,000 & 53,001 to 53,008	2½	Nil	Nil	2½%	2½%	1⅛ — 1⅜	1⅛ — 1⅜	..	..	..	4 8 4
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Bras. Sub. Tel.	100	4 %	4 %	4 %	4 %	100 —103	100 —103	..	..	..	3 17 8
207,980	Western Telegraph, Ltd., Nos. 1 to 207,980.. ..	10	7 %	7 %	7 %	7 %	13⅜ — 14⅛	13⅜ — 14⅛	14 1/16	13½	..	4 18 3
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	102 —104	102 —104	102½	102½	..	3 16 11
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	⅛ — ¼	⅛ — ¼	13/1½	11/10½	+ 1/16	Ni
34,563	Do. do. 6 % Cum. 1st Pref.	10	6 %	5 %	8 %	6 %	8 — 8½	8 — 8½	..	..	..	7 1 2
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	Nil	£2 6	8½ — 9½	8½ — 9½	9	..	..	2 9 0
80,000£	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	101 —103	101 —103	..	..	..	4 17 1

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

320,000	Anglo-Argentine Trams, 10 % Nom. Cum. 2nd Pref., 260,008 to 580,097	5	8 %	8 %	8 %	9 %	8¼ — 8½	8⅜ — 8⅝	8 5/16	8 5/16	..	5 5 11
260,007	Do. 6 % Cum. Prefs., 1 to 260,007 ..	5	5⅛%	5⅛%	5⅛%	5⅛%	6¼ — 6½	6 5/16 — 6 5/16	6½	6⅜	+ 1/16	4 10 3
266,600	Do. Permanent, 6 % Deb. Stock, 1888	100	6 %	6 %	6 %	6 %	143 —146	141 —146	..	..	—2	4 2 2
285,100	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	102 —105	102 —105	..	..	..	4 15 3
880,000	Babcock & Wilcox, 1 to 880,000	1	20 %	20 %	20 %	20 %	9⅜ — 9⅝	9 1/16 — 9 3/16	76/6	76/3	+ 1/16	5 1 3
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1⅛ — 1⅜	1⅛ — 1⅜	..	..	..	3 13 10
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	7 %	7 %	2⅜ — 2½	2⅜ — 2⅝	49/4½	45/-	— ½	13 0 6
6,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	3¾ — 4	3¾ — 4	..	..	..	8 15 0
40,000	Do. do. "A" 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	4¼ — 4½	4¼ — 4½	..	..	..	6 6 4
11,897	Do. do. 4 % Funding Certs.	5	4 %	4 %	4 %	4 %	3¾ — 4¼	3¾ — 4¼	..	..	..	4 14 1
43,478	Do. do. 5 % 1st Mort. Deb. Stock Red.	Stock	5 %	5 %	5 %	5 %	106 —110	106 —110	..	..	..	4 10 11
800,000	Do. do. 5½ % Loch Leven Debs. ..	100	..	..	5½%	5½%	97 —100	97 —100	98½	98	..	5 10 0
400,000	British Columbia E. Rail Def. Ord. Stock ..	100	6 %	6 %	6 %	8 %	135 —139	135 —139	137½	137	..	5 15 1
400,000	Do. 5 % Pref. Ord. Stock	100	5 %	5 %	5 %	5 %	117 —121	117 —121	117	..	..	4 2 8
800,000	Do. 5 % Cum. Perp. Pref. Stock ..	100	5 %	5 %	5 %	5 %	106 —110	106 —110	109	..	..	4 10 11
288,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250 ..	40	4½%	4½%	4½%	4½%	103 —105	101 —103 xd	..	..	—2	10 17 6
220,000	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 7 0
188,301	British Electric Traction	10	6 %	3 %	Nil	Nil	⅝ — 1⅛	¾ — 1⅛	21/3	..	..	Nil
161,497	Do. do. 6 % Cum. Pref.	10	6 %	6 %	6 %	6 %	3⅜ — 4⅛	3⅜ — 4⅛	..	..	..	7 1 2
1,473,653	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	91 — 96 xd	90 — 95	92	..	—1	5 5 3
528,936	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	76 — 78	76 — 78	..	..	..	5 16 5
100,000	British Insulated and Helsby Cables	5	8 %	8 %	10 %	10 %	6½ — 6⅝	6½ — 6⅝	..	..	..	7 8 2
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6 — 6⅛	6 — 6⅛	..	..	..	4 12 4
500,000	Do. do. 4½ % 1st Mort. Deb. Red...	100	4½%	4½%	4½%	4½%	103 —106	103 —106	..	..	..	4 4 11
208,440	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	91 — 96	91 — 96	..	..	..	4 13 9
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	Nil	Nil	Nil	Nil	1/16 — 3/16	1/16 — 3/16	..	..	..	Nil
1,016,358	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	40 — 45	40 — 45	..	..	..	9 17 10
50,000	Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	Nil	1/16 — 1/8	1/16 — 1/8	..	..	..	Nil
60,000	Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	Nil	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
105,731	Brush Electrical Engineering, Ord., 1 to 105,731 ..	2	Nil	2½%	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
150,000	Do. do. Non-cum. 6 % Pref.	2	6 %	6 %	Nil	Nil	⅛ — ¼	⅛ — ¼	..	..	..	Nil
125,000£	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	68 — 73	68 — 73	..	..	..	6 8 3
125,000£	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	50 — 54	50 — 54	..	..	..	8 6 0
137,610	Calcutta Trams, 1 to 137,610	5	8 %	8 %	8 %	6 %	4½ — 5½	5⅛ — 5⅝	5⅛	97/6	— ⅛	5 11 8
45,404	Do. 5 % Cum. Pref., Nos. 1 to 29,030..	5	..	5 %	5 %	5 %	4½ — 6½	4½ — 6½	..	..	..	4 15 9
350,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	103 —106	103 —106	..	..	..	4 4 11
35,000	Callender's Cable Construction shares	5	12½%	15 %	15 %	15 %	9½ — 10½	9½ — 10½	..	..	..	7 2 10
40,000	Do. do. 6 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5⅜ — 5⅝	5⅜ — 5⅝	..	..	..	5 6 11
200,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	107½ —109½	107½ —109½	..	..	..	4 2 2
491,222	Cape E Trams., 1 to 491,222	1	5 %	Nil	Nil	Nil	⅛ — ¼	⅛ — ¼	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	4 %	6 %	8 %	12 %	1 1/16 — 1 1/8	1 1/16 — 1 1/8	22/3	..	..	7 14 10
210,153	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	4½%	103 —107	105 —107	105	..	..	4 4 1
1,393,610	Central London Railway, Ord. Stock	Stock	4 %	4 %	4 %	3 %	69 — 71	69 — 71	70⅜	69	..	4 4 6
553,195	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	86 — 88	86 — 88	87½	..	..	4 10 11
553,195	Do. do. Def. do.	Stock	4 %	4 %	4 %	2 %	49 — 52	49 — 52	52	51½	..	3 16 11
1,480,000	City and South London Railway	Stock	3½%	12½	3½%	3½%	32½ — 33½	32½ — 33½	33½	..	..	6 6 10

* Unless otherwise stated, all shares are fully paid. † A period of nine months. ‡ From Manchester Square List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1904.	1905.	1906.	1907.	Closing Quotations Oct. 13th.	Closing Quotations Oct. 20th.	Business done week ended Oct. 20th, 1908. Highest.	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
85,000	Crompton & Co., Nos. 1 to 85,000	S	2½%	2½%	5 %	5 %	1⅞— 1⅞	1⅞— 1⅞	..	..	..	9 10 6
100,000	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £60 Red.	..	5 %	5 %	5 %	5 %	98 —101	98 —101	..	..	..	4 19 0
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	10 %	10 %	1⅞— 1⅞	1⅞— 1⅞	..	..	..	7 12 5
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000	1	6 %	6 %	6 %	6 %	1 — 1⅛	1 — 1⅛	28/-	..	..	4 16 0
276,880	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
60,000	Dublin United Trams. (1896), 1 to 60,000	10	6 %	6%	6 %	6¾%	11⅜— 12⅛	11⅜— 12⅛	..	..	..	5 4 0
60,000	Do. 6 % Pref. between 1 and 60,000	10	6 %	6 %	6 %	6 %	12⅜— 13⅛	12⅜— 13⅛	..	..	..	4 8 11
99,261	Edison & Swan Utd., "A" shs., £8 pd., 1 to 99,261	5	2½%	4½%	4½%	4½%	⅞— 1	⅞— 1	14/4½	..	— 1/6	18 2 0
17,189	Do. "A" shares, 01—017,189	5	2½%	4½%	4½%	4½%	1 — 2⅛	1 — 2⅛	..	..	..	8 6 9
317,975	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	76 — 79	76 — 79	..	..	..	5 1 3
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	84 — 87	84 — 87	..	..	..	5 14 11
112,100	Electric Construction, 1 to 112,100	2	4 %	Nil	Nil	Nil	⅞— 1⅛	⅞— 1⅛	..	..	..	Nil
31,890	Do. do. 7 % Cum. Pref., 1 to 31,890	2	7 %	7 %	7 %	7 %	1⅜— 1⅝	1⅜— 1⅝	..	..	..	8 0 0
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	5 %	7⅞— 8	7⅞— 8	..	..	— ½	6 9 0
200,000	Do. do 4 % Mort Deb.	Stock	4 %	4 %	4 %	4 %	84 — 88	84 — 88	..	..	..	4 10 11
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	4 %	4 %	4 %	¾— 1	¾— 1	..	..	..	5 0 0
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	7 %	10⅜— 10⅝	10⅜— 10⅝	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103	102 —103½	..	..	..	4 17 1
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15 %	15%	15 %	15%	10⅜— 11⅛	10⅜— 11⅛	10⅜	..	..	7 8 2
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5 — 5⅛	5 — 5⅛	..	..	..	4 1 10
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	107 — 109	107 —109	..	..	..	4 2 7
50,000	India-Rubber, Gutta-percha & Telegraph Works.	10	5 %	10%	10 %	10 %	16½— 17½	16½— 17⅛	16½	..	..	5 14 3
37,500	†Liverpool Overhead Railway, Ord.	10	1½%	Nil	Nil	⅜%	1⅛— 1⅜	1⅛— 1⅜	..	..	..	4 0 0
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	5 %	5 — 5⅛	5 — 5⅛	..	..	..	9 1 10
600,070	London United Trams. (1901), 1 to 50,007	10	6 %	8 %	8 %	8 %	6⅛— 6⅜	6⅛— 6⅜	..	..	..	4 8 11
999,980	Do. do. 60,008 to 100,000	10	6 %	8 %	8 %	8 %	6⅛— 6⅜	6⅛— 6⅜	..	..	..	4 8 11
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	5 %	4½ — 5⅛	4½ — 5⅛	97/6	..	..	9 1 10
1,381,000	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	73 —¿78	72 — 77	..	..	—1	5 3 11
5,782,062	Metropolitan Consolidated	100	3%	2%	1 %	½%	39⅛— 40⅛	38⅛— 39⅛	41	38⅜	—1	1 5 4
2,640,914	Do. Surplus Lands	100	2½%	2½%	2½%	2½%	68 — 70	68 — 70	69	..	..	3 18 7
3,285,000	Do. District	100	Nil	Nil	Nil	Nil	13 — 14	13 — 14	14	12½	..	Nil
314,016	Metropolitan Electric Trams., Defd.	1	Nil	Nil	Nil	Nil	⅝— ¾	⅝— ¾	1/6	1/-	..	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	15/16— 15/16	15/16— 15/16	16/-	15/6	— 3/32	5 19 5
823,800	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	92 — 95	92 — 95	..	..	..	4 14 9
245,500	Potteries E. Tre.	1	5 %	4 %	4 %	4 %	¼— ⅜	¼— ⅜	..	..	..	8 0 0
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	⅜— ½	⅜— ½	..	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	92 — 95	£2 — 95	..	..	..	4 14 9
37,350	Telegraph Construction and Maintenance	12	15 %	15 %	15 %	17½%	32 — 34	32 — 34	32½	..	..	6 18 8
150,000	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	101 —103	101 —103	..	..	..	3 17 8
3,599,200	Undergd. E. R., Lon., 5 % Profit Shar. S. Nts.	..	5 %	5 %	5 %	5 %	43 — 47	43 — 47	..	..	..	10 12 0
66,666	Willans & Robinson, 1 to 30,000 & 30,001 to 116,666	1	Nil	Nil	Nil	10 %	⅜— 1⅜	⅜— 1⅛ xd	..	..	..	8 0 0
66,666	Do. 6 % C.P., 30,001 to 30,000 & 125,001 to 141,666	5	Nil	Nil	..	6 %	2⅛— 3⅛	2⅛— 3 xd	57/6	..	..	10 0 0
216,404	Do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	72 — 76	72 — 76	..	..	..	5 5 3

ELECTRICITY SUPPLY COMPANIES.

10,000	Bromley (Kent) E.L. & P., 1 to 15,000	5	5½%	5½%	5½%	5½%	4⅜— 4¾	4⅜— 4¾	..	..	..	5 11 5
70,000	Do. do. 4½ % 1st. deb. stock	100	4½%	4½%	4½%	4½%	96 —100	96 —100	..	..	..	4 10 0
30,275	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10 %	10%	10 %	7 — 8	7 — 8	..	..	..	6 5 0
9,725	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	7 — 8	7 — 8	7 7/16	..	..	4 7 6
836,876	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	99 — 102	99 —102	..	..	..	3 18 5
60,000	Charing Cross and Strand Electricity Supply	5	8 %	5 %	5 %	5 %	8⅜— 8⅞	8⅜— 8⅞	76/10½	..	..	6 9 0
80,000	Do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	3⅞— 4⅛	3⅞— 4⅛	..	..	— ⅛	5 5 11
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3⅞— 4	3⅞— 3⅞	72/6	70/-	— ½	6 0 0
445,736	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	96 — 99	96 — 99	..	..	..	4 10 11
49,486	Chelsea Electricity Supply, Ord.	5	6 %	6 %	4½%	4½%	2⅞— 3⅛	2⅞— 3⅛	..	..	..	6 13 4
175,000	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	6 %	9½— 10½	9½— 10	10	..	— ½	6 0 0
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	12 — 13	12 — 13	..	..	..	4 12 4
400,000	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	122 —125	122 —125	..	..	..	4 0 0
300,000	Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
50,000	County of Durham Electrical Power, Ord.	5	£3 7 0	4 %	4 %	2 %	2⅞— 3	2⅞— 3	..	..	..	3 6 8
50,000	Do. do. do. 5 % Pref.	5	5 %	5 %	5 %	5 %	3⅝— 4⅛ xd	3⅝— 4⅛	75/-	73/9	..	6 1 3
200,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	..	..	.. ..	99 —101	..	..	..	..
40,000	County of London Electric Lighting, Ord. 1—40,000	10	4½%	5 %	5 %	5 %	7 — 8	7 — 8	..	..	..	6 5 0
50,026	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10⅛— 10⅝	10⅛— 10⅝	10⅜	..	..	5 11 8
400,000	Do. do. 4½ % Deb. Stock	..	4½%	4½%	4½%	4½%	107 —110	107 —110	..	..	..	4 1 10
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	4½%	99 —102	99 —102	..	..	..	4 8 3
80,000	Edmundson's Electric Corporation, Ord. Shares	5	7 %	4 %	Nil	Nil	⅛— ¼	⅛— ¼	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	3 %	Nil	¾— 1	¾— 1	15/9	14/-	..	Nil
430,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	59 — 66	59 — 66	..	..	..	6 16 4
$8,150,000	Electrical Dev. Co. of Ontario, 5% 1st Mtg. Gold Bnds.	$500	..	..	..	..	83½— 86½	83½— 85½	..	..	..	..
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4⅝— 5⅛	4⅝— 5⅛	..	..	..	5 4 9
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	5 — 5⅛	5 — 5⅛	..	..	..	4 10 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	97 —100	97 —100	..	..	..	4 10 11
15,000	Hove, 1 to 15,000	5	6½%	9 %	9 %	8½%	6 — 6½	6 — 6½	..	..	..	6 10 9
$1,325,000	Kaministiquia Power Co., 5 % Gold Bnds.	..	..	..	..	..	94 — 96	94 — 96	..	..	..	..
21,000	Kensington and Knightsbridge Electric Ord.	5	12 %	10 %	10 %	10 %	7⅞— 8⅛	7⅞— 8⅛	..	..	..	5 14 3
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	94 — 97	94 — 97	..	..	..	4 2 6
111,000	London Electric Supply Corporation, Limited, Ord.	5	3 %	4 %	4 %	2½%	⅞— 1⅛	⅞— 1⅛	..	..	..	5 8 1
70,000	Do. do. do 6 % Pref.	5	6 %	6 %	6 %	6 %	4⅜— 4⅝	4⅜— 4⅝	..	..	..	6 9 9
371,895	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4 %	4 %	4½%	89 — 92	89 — 92	91	..	..	4 17 10
100,000	Metropolitan Electric Supply, 1 to 100,000	5	10 %	10 %	8 %	6½%	4⅛— 4⅜	4⅛— 4⅜	..	..	..	6 16 10
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅜— 4⅝	4⅜— 4⅝	90/-	..	..	4 12 4
220,000	Do. 4½ % 1st Mort. Deben. Stock	..	4½%	4½%	4½%	4½%	105 —109	105 —109	..	..	..	4 2 7
248,000	Do. 3½ % Mort. Deben. Stock Redeem.	Stock	3½%	3½%	3½%	3½%	84 — 89	84 — 89	..	..	..	3 18 8
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	..	5 %	5 %	5 %	5 %	88 — 89	89 — 90	£9	88	..	5 9 11
$13,585,000	Do. Light and Power Co., Ltd., Common	$100	..	..	..	..	78½— 80½	77 — 78	81½	78	..	..
$1,500,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	..	..	111½—112½	112 — 113	113	112	..	..
$12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	..	..	..	..	..	88½— 90½	90½— 91½	91½	90½	+1½	..
450,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	94 — 97	95 — 98	96½	..	+1	4 11 10
87,500	Newcastle-on-Tyne, 1 to 87,500	5	8 %	8 %	8 %	8 %	5½— 5⅝	5½— 5⅝	..	..	..	7 19 2
87,500	Do. 5 % Pref., 1 to 87,500	5	5 %	5 %	5 %	5 %	5⅜— 5⅝	5⅜— 5⅝	..	..	..	4 6 11
? 10,852	Notting Hill Electric Lighting	10	7 %	7½%	7½%	7½%	11⅞— 12⅜	11⅞— 12⅜	..	..	..	5 17 8
20,000	Oxford, 1 to 95 and 407 to 20,310	5	7 %	7 %	7 %	7 %	5⅝— 6⅛	5⅝— 6⅛	..	..	..	5 14 3
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	95 — 99	95 — 98	..	..	..	4 1 8
119,691	River Plate Elcty. Co. Ord. Nos. 1 to 120,507	1	..	..	2½%	..	1⅛— 1⅜	1⅛— 1⅜	23/9	23/6	..	..
100,000	Do. do. 6% Non Cum. Pref. Nos. 1 to 100,000	1	6	6	6	6	1⅝— 1⅞	1⅝— 1⅞	..	..	..	..
194,684	Do. do. 5% Deb. Stk. Red.	100	5	5	5	..	99 —101	99 — 102	100⅝	..	..	4 18 0
40,000	St. James' and Pall Mall Electric Light, Ord.	5	14½%	12½%	10 %	10 %	7⅛— 8⅛	7⅛— 8⅛	7⅞	7⅞	..	6 1 3
20,000	Do. do. 7 % Pref. 20,001 to 40,000	5	7 %	7 %	7 %	7 %	6⅝— 7⅛	6⅝— 7⅛	..	..	..	4 16 7
150,000	Do. do. 3½ % Deb. Stock Red.	100	3½%	3 %	3½%	3½%	86 — 90	86 — 90	88½	..	..	3 17 9
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	4 %	Nil	Nil	⅛— ¼	⅛— ¼	..	..	..	Nil
46,700	Do. do. do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	68 — 72	68 — 72	..	..	..	5 11 1
65,000	South London Electricity Supply, Ord.	5	4 %	4 %	3 %	4 %	2½— 2⅝	2½— 2⅝	..	..	..	7 5 5
120,000	South Met. Elec. Lt. & Power, Ord.	1	Nil	2½%	2½%	2½%	⅛— ¼	⅛— ¼	..	..	..	4 0 0
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1⅛— 1⅜	1⅛— 1⅜	21/3	20/7½	..	6 4 5
200,000	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	99 —101	99 —101	..	..	..	4 9 1
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	1 — 1	1 — 1	..	..	..	20 0 0
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	1⅝— 2⅜	1⅝— 2⅜	..	..	..	10 10 6
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	80 — 83	80 — 83	..	..	..	5 8 5
800,000	Victoria Falls Power Co., Pref. Nos. 1 to 800,000	1	..	..	..	..	⅝— ¾	⅝— ¾	..	..	..	..
110,000	Westminster Electric Supply, Ord.	5	14 %	12 %	12 %	10 %	6 — 8	7⅜— 8⅜	8⅛	7⅞	— ⅛	5 17 8
81,279	Do. do. 4½ % Cum. Pref. (Original 5 %.—Red. to 4½ % from 31st Dec., 1908)	5	5 %	5 %	4½%	4½%	5 — 5⅛	5 — 5⅛	5⅛	..	..	4 1 10

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange. § Interim Dividend.

Bank rate of Discount 2½ per cent. May 28th, 1908.

TRADE STATISTICS OF HOLLAND IN 1907.

The following figures are taken from the recently issued trade statistics for 1907; corresponding figures for 1906 have been added for purposes of comparison, and notes of increases or decreases are given:—

	1906. Gulden.	1907. Gulden.	Increase or decrease. Gulden.
Industrial, Agricultural, and Steam Machinery.—			
From Belgium	1,856,583	2,364,329	+ 507,746
„ Great Britain ...	6,922,500	6,233,447	— 689,053
„ Germany	10,615,906	13,139,954	+2,524,048
„ United States ...	2,725,529	3,276,097	+ 550,568
„ Other countries ...	347,414	399,805	+ 52,391
Total	22,467,932	25,413,632	+2,945,700
Iron Wire.—			
From Belgium	486,917	708,563	+ 221,646
„ Great Britain ...	499,071	36,621	— 462,450
„ Germany	19,737,606	17,406,475	—2,331,131
„ Sweden	409,724	276,928	— 132,796
„ Other countries ...	10,435	1,395	— 9,040
Total	21,143,753	18,429,982	—2,713,771
Mathematical, Physical, &c., Instruments.—			
From Belgium	549,000	562,000	+ 13,000
„ Great Britain ...	314,000	380,000	+ 66,000
„ Germany	3,800,000	3,923,000	+ 123,000
„ Other countries ...	128,000	132,000	+ 4,000
Total	4,791,000	4,997,000	+ 206,000
Copper Wire.—			
From Belgium	149,000	146,000	— 3,000
„ Great Britain ...	63,000	77,000	+ 14,000
„ Germany	2,186,000	2,982,000	+ 796,000
„ Other countries ...	110,000	4,000	— 106,000
Total	2,508,000	3,209,000	+ 701,000
Steel Wire.—			
From Belgium	722,000	4,040,000	+3,318,000
„ Great Britain ...	429,000	591,000	+ 162,000
„ Germany	14,610,000	8,305,000	—6,305,000
„ Other countries ...	16,000	26,000	+ 10,000
Total	15,777,000	12,962,000	—2,815,000
India-rubber, Manufactured.—			
From Belgium	182,000	278,000	+ 96,000
„ Great Britain ...	966,000	1,211,000	+ 245,000
„ Germany	977,000	1,039,000	+ 62,000
„ Other countries ...	14,000	26,000	+ 12,000
Total	2,139,000	2,554,000	+ 415,000
Gutta-percha, Manufactured.—			
From Belgium	583,000	549,000	— 34,000
„ Great Britain ...	261,000	297,000	+ 36,000
„ Germany	204,000	250,000	+ 46,000
„ Other countries ...	31,000	36,000	+ 5,000
Total	1,079,000	1,132,000	+ 53,000

Note.—Gulden = 1s. 8d.

Cable Works Sold by Auction.—The electrical cable works which were established in Barkerend Road, Bradford, some years ago by Mr. Wm. Terrell Garnett, whose bankruptcy has recently been reported, were offered for sale by public auction on Thursday last week, by Mr. J. T. Rushton, of Messrs. E. Rushton, Son & Kenyon, Manchester. The auctioneer offered the business as a going concern, and said he would prefer a reasonable offer on those lines. The first bid was £1,000, and the bidding rose by separate bids of £1,000 to £4,000. The auctioneer then offered to take bids of £250, and by this means the offers were advanced to £4,500. After conferring with the Committee of Inspection appointed to deal with the estate, the auctioneer stated that he was reluctantly compelled to accept the last offer, which was considerably below the value of the business even if it were sold in lots. The purchaser was Mr. Thomas C. Thompson, of Messrs. T. C. Thompson & Son, Oxford Works, Great Bridgewater Street, Manchester. The sale was attended by a large number of persons, and several of the principal electric cable manufacturing firms of the country were represented.

ARE BRANCHES BENEFICIAL?

By VILEX.

Considering the present state of keen competition, and consequent low profits, a very small leakage makes all the difference between profit and loss. It is necessary therefore that the manufacturer should run his whole establishment on the most economical lines consistent with efficiency. An economically and well managed works is useless if combined with an inefficient sales department, and *vice versa*. In the present article the writer proposes to deal only with the subject of branches.

A curious anomaly presents itself, in the fact that some companies establish agencies in the chief towns in England, other companies branches, and yet others branches and agencies mixed. Let us briefly consider the advantages, or alleged advantages of each system, so as to decide which is probably the most economical. In searching for the advantages, a strange fact is at once noticed, that the system of establishing branches is general amongst the electrical and gas-engine manufacturers, but not so common in other trades. This leads one to the question: "Are there any peculiarities in these trades which render branches an advantage?"

Manufacturers assert that there are, but inquiry seems to cast doubt upon this point. In the case of gas-engine manufacturers, these have always dealt direct with consumers, and each branch has generally a repair shop, and an erecting staff; and no doubt equipped like this it serves a useful purpose.

Electrical branches, on the other hand, are a different matter, and it is only these that we intend to discuss. The first claim put forward in their favour is that, owing to the diversity of manufacture, multiplicity of standards, and variety of designs, it is advantageous to have an engineer trained in the special methods of the firm on the spot to obtain inquiries and interview customers. This argument is largely discounted by the fact that most branch managers are men from other companies, appointed, and placed in their respective branches, after a superficial knowledge has been obtained by a short stay at their works, kept up afterwards by a few flying visits. When any important tender is being decided, you will find that a specialist is sent down from the works, or head office, to interview the customer, proving that the head office really know that their branch manager is not fully acquainted with their methods, and is an ordinary individual who requires backing up.

Another favourite argument is that a branch can carry a stock. This is really only endeavouring to confuse a simple issue. A branch is a branch, and a store is a warehouse. The fact that a firm places these two things in the same town, or even in the same building, does not make them identical, nor prove them to be necessary or economical. Keeping a stock is not an unmixed blessing. Customers come to rely on walking in, asking for something, and taking it away. It is hard in cases of sudden demand, except by carrying a large stock, to be sure of always having what is required, and after a few disappointments, customers go to another store. Besides this, each store has to stock a lot of materials for which there is only a slight demand, and these depreciate, and finally have to be written off; whereas if held at works they could have been turned over several times. Also, there are always in every large town several factors and merchants, with good settled connections, ready to accept agencies and carry stock at a commission, which is practically only an ordinary commission, plus warehousing rates.

This brings us to the great point that manufacturers maintain—that branches are cheap. Let us carefully consider this point, because if it is wrong, the chief, and, in fact, the only real claim in favour of branches, fails. In branch management it is usual to appoint a manager, giving him a salary, more or less small, and the promise of a small commission on turnover, and profits. Of course, this does not hold good in all cases, but where it does there is generally a constant difference between the manager and the head office as to the amount of commission owing to him. This is a serious charge to make, but the fact is well known among salesmen that many manufacturers do not pay commission fairly. All sorts of dodges are resorted to, in order to reduce the

sum, such as charging a percentage on head-office expenses, capital charges, claiming orders as received direct, and cutting branch commission. The question will be asked, "Why, if companies do not treat their servants fairly, do they stay with them?" The answer is, "They don't!" Changes are continual, and how often do we hear that a salesman has left a company and joined a rival firm, or started as an agent for himself in the same district. This form of leakage is very bad for the manufacturers, as it means that they take a man, pay him to work up a connection, and then find that he starts as an agent for himself, or joins a rival firm, having worked up a connection at their expense, and generally takes the cream of their business. The difficulty appears to arise chiefly from the stupid English custom of paying a man as little as you can, instead of like the Americans, paying him what he is worth to you.

Even presuming that things run smoothly, the question still remains, "Are branches cheaper than agencies?" A branch for a large electrical firm, to be run in a proper manner, has to be established in an expensive office, and kept up at first-class expenses. These heavy out-goings have to be paid alike in good times and bad. In other words, whether orders come in or not, the expenses are the same. This point is more accentuated in the case of establishing new branches. For the first year or two, whilst working up a connection, orders are few, and expenses exceptionally heavy.

On the other hand, an agent has generally several agencies for different classes of machinery, and is, therefore, less affected by a bad time in one particular trade. He can consequently afford to work at a less margin of profit. If there is a bad time in the electrical business, he still gets good orders for mechanical machinery, and so forth. In fact, "what he loses on the swings, he gets back on the roundabouts." Also, by selling several different things, he is more in touch with customers, and more likely to get inquiries than a branch which only sells electrical gear, and cannot afford to call often on out-of-the-way works, on chance.

Besides this, if there is no trade, the manufacturer pays nothing to the agent.

Let us take a concrete instance Last year an agent for one particular manufacture was drawing £150 a year commission, and doing a turnover of £3,000. This year, with bad trade, and another and cheaper article, trade in this line has almost totally disappeared. The agent still does well in other things, and the manufacturer has only lost his trade, but no out-of-pocket expenses.

Now, an agent's usual commission for electrical material is 5 per cent. As a matter of fact, it works out generally less than this, because in some goods, for instance, bare and c.c. wire, it is only 1 per cent. to 2 per cent., and in cases of keen competition it is generally cut to 2½ per cent. for any kind of material. For a branch, therefore, to yield a better result, it is necessary that their total expenditure should be less than 5 per cent., probably about 4 per cent. of their turnover. Is this often the case?

An ordinary branch for a large company will generally cost about £1,500 a year. This would necessitate the branch doing £37,500 a year turnover. This, of course, is only a small branch. There is one company in England which has nine branches in the United Kingdom. One, we believe, contains over 30 people, and costs from £5,000 to £10,000. Take the average of their branches to be £2,500. This means a total expenditure of £22,500 per year, and at 4 per cent. a turnover of £562,500. If we except, or only partly credit, orders put out to public tender, and inquiries sent direct, this turnover seems improbable. Also two of the branches are in towns less than an hour's journey apart by train, which seems a foolish duplication of branch expenses.

Just now the electrical trade is complaining of German competition, but it is noticeable that though there is a great deal of business done in England by astute foreign firms, it is mostly done through agents and merchants. Only a few of the larger firms have any branches, and then generally only one in London, whose chief use is to look after their agents. Indeed, America is far ahead of us in its use of agencies. Often you will find that one agent controls a large works, guarantees to buy all their output, and sells for them, making his own prices. Manufacturers are slowly waking up to the fact that we suffer from heavy selling costs, and a larger amount of agencies are being created every day. The plain fact is that an agency is only a combination of several manufacturers, whereby the agent is empowered to sell different classes of goods for several different firms. When trade is bad in one class of goods, the others carry the business on without letting the expense fall on any particular manufacturer. This is simply a combination of interests, the same as is practised by large stores. Just so surely as large stores, by their varied interests, can afford to outsell small shops, so can agencies work more cheaply than branches.

When all manufacturers realise this, branches will be abandoned for agencies. Indeed, it seems as if the time would finally arrive when no manufacturer would think of selling his goods direct. Then agents, merchants and factors, with their better business organisation and connection, will practically buy up the whole output, and the manufacturer will confine his attention strictly to his factory.

THE ELECTRIC POWER COMPANIES OF THE UNITED KINGDOM AND THEIR PROSPECTS.

By G. L. ADDENBROOKE.

It is now about eleven years since the first public notices were given asking for legislative permission for the public supply of electric power. In the interval which has elapsed up to the present date, Electric Power Acts covering about 25 areas, including Ireland, have been passed, and about 15 of the companies so incorporated have commenced operations.

It is difficult to state exactly what is the amount of plant installed or in process of installation under the various Acts, but it is in the neighbourhood of 160,000 KW., including spares. It is also not easy to give exactly the aggregate paid-up capital and loans of the various companies to date, but it will be sufficient to say that it is in excess of £7,500,000.

When, however, we come to inquire into the distribution of this expenditure, considerable anomalies present themselves. If the capital involved, as above mentioned, is allocated to the different companies, it will be found that the Newcastle Co. with its allies, the County of Durham Co., the Cleveland and Durham Co., and the Durham Collieries Co., accounts for nearly one-half, and the balance is distributed amongst the other companies, and includes their Parliamentary costs and other initial expenditure, which naturally form a larger proportion of a company's capital than when it has been working some time and further capital issues have been made almost entirely for expenditure on works. Taking these facts into account, if the capital spent on works only by the various companies is considered, it apparently results that nearly six-tenths of the total capital expended by electric power companies on works has been, or is being, expended by the Newcastle company and its allies in the North-East coast industrial district, as against four-tenths by the other companies spread over the industrial districts of the whole of the rest of the United Kingdom.

The subscribed capital and debentures of the Newcastle company itself amount to about £1,800,000, and that of its allies to about a similar sum. When we turn to the other companies we find paid-up capitals of £250,000 to £600,000, and smaller sums which have been subscribed in some cases to maintain rights under Acts until better times.

Coming next to the financial position of the companies, the ordinary shares of the Newcastle company stand slightly above par, but those of the next company on the list are at a considerable discount. In a few cases the preference shares stand at a fair level, but most of the share capital of the different companies has, so far, had to be found by friends and supporters, and there are no generally current Stock Exchange quotations.

It may be said that practically all those companies which have made a start are doing something more than pay their working expenses; in some cases they are able to meet their debenture interest, and three or four are able to meet their preference share interest also, while in one or two cases,

besides the Newcastle company, something is being paid on the ordinary share capital. The last-named company has, as is well known, been paying an 8 per cent. dividend on its ordinary capital for several years, though some of its critics consider this too high in view of the sums set aside for depreciation.

It will be well now to pass on to consider why, outside the Newcastle group, greater progress has not so far been made.

This is due chiefly to the following causes :—

By the Acts themselves, there was forced on the promoters an obsolete scheme of finance which has occasioned much trouble, and has led in most cases to a second limited company being formed to hold the Parliamentary company in trust, an expensive expedient to get over a difficulty which reflects very severely on our Parliamentary methods.

Again, although the original idea of the Government in allowing these Acts to be passed was to help the industry by reverting to the form of the Acts which are granted to railway, gas and water undertakings, yet, nevertheless, the Power Acts were still left, subject to legislation by provisional order, and no proper attempt was made to reconcile the two overlapping methods of proceeding. Such attempt as was made roughly to regularise the position and put it on a business basis, by means of the Kitson clause, has been almost wholly defeated by local authorities having provisional orders. One effect of this confusion has been that after obtaining their Acts, most of the power companies have had to spend much valuable time and money in negotiation to clear the ground and establish a sufficiently large free area in their territory to warrant the expenditure of capital. In other cases, where capital has been spent and stations have been erected without doing this, great delay and uncertainty have subsequently arisen while negotiations of this character were proceeding.

It must also be acknowledged that the improvements made during the last five or six years in the economy of isolated plants, and especially the extravagant claims made on behalf of suction gas plants, have tended to reduce the market value of energy for power purposes. Power companies and municipalities are finding that they can compete successfully against this class of plant anywhere along the lines of their mains, but at a somewhat reduced margin of profit to that which could formerly have been obtained, and which would have been very acceptable in the early stages of these undertakings when the load being comparatively small, economical working cannot be fully attained.

Then there have been the difficulties of arriving at an understanding with customers; to arrange with customers to take 10-H.P. or 20-H.P. motors is one thing, but to negotiate for the supply of 100 H.P. to 500 H.P. is another. The cost of power in relation to the quantity used and the hours of use, has until lately been very little understood, and it is astonishing how difficult many non-technical people find it to grasp the ideas involved. Every power company in its own area, and dealing with the special trades of its district, has had to build up a body of experience to enable it to cope with these problems. An example will show over what periods such negotiations may extend. Not infrequently a manufacturer will discuss for six months the question of taking power, before making up his mind to place his initial order, which is often not very large. Then about three months is usually consumed in settling designs, obtaining tenders and finally arranging how everything is to be carried out. The building of the requisite motors, and their installation together with the changes required in the factory will consume another three or four months. Lastly, before going in for extensions, a manufacturer will require the initial plant to run for at least six months to enable sufficient data to be accumulated to show what success has been attained. Thus a period of 18 months soon passes in the early stages of power supply, though afterwards progress will be easier and more rapid.

When it is recollected that it usually takes 18 months or two years after an Act has been passed to make the necessary arrangements for the placing of the company on a working basis and for obtaining finance; that to build and equip a power station occupies usually 15 to 18 months; that it has, so far, been found difficult to secure contracts until the power station has been built, and that then the first consumers take some such time as has been mentioned to come on in any number, it will be seen how the first four or five years after the passing of a Power Act may readily elapse without any remarkable results being apparent, though an immense amount of arduous foundation work may have been got through, which will tell later on.

Another obstacle, which all the power companies have had to contend with during the last two and a half years, has been the straitness of finance occasioned by the trouble which occurred in connection with the South Wales Co. This has arrested development in many directions, though there are signs that the cloud is now beginning to lift.

In spite, however, of these and other difficulties which the power companies have had to encounter, most of them, as has already been mentioned, have now accumulated sufficient business to more than meet their working expenses, while still having in reserve a considerable proportion of their plant and mains. Additional business will now be more quickly obtained and show a much larger margin of profit, and by the time these plants are filled up there will be sufficient excess income to permit of raising more capital for extensions. The earning powers of this additional capital ought to be sufficient not only to pay interest on itself, but to leave some margin towards providing a return on the original capital; how much, will, of course, be a separate problem in each case. From the engineering standpoint, therefore, most of the power companies who have started have now passed the most trying point in their careers, and future progress is assured, though it may be a long time in some cases before the original investors receive any adequate reward for their enterprise.

It must also be recollected that electric power companies were started on the basis that by concentration and working on a large scale great economies in generation and distribution would be effected; but so far, outside the Newcastle group, this position has hardly yet been attained. In the case of a power company operating in a first-class industrial district and having to rely for its revenue on power sales, and without the advantage of a large accessory lighting or other business to help it in the initial stages, the overhead and other charges press heavily on the undertaking until it has been able to reach a regular output of 4,000 to 5,000 KW. It is only as this output is approached that such undertakings may be considered as getting on a business footing. When once this critical stage is passed, not only is the cost of extending the plant and mains less per kilowatt, but the staff and administration which are necessary to deal effectively with 5,000 KW. can, with relatively small additions, deal with 10,000 to 15,000 KW., which must still be accounted a small output for a power company in a good district.

There is, therefore, reason to anticipate that most of the power companies will show much better results in the immediate future than they have been able to do hitherto, and that their progress will be cumulative.

As to what can be done under satisfactory conditions in a favourable area, we have the example of what has already been accomplished in the North-East Coast industrial area, particulars of which have been recently given by Mr. Merz in a paper before the Iron and Steel Institute. From this we learn that there are now in this area eight generating stations in operation, containing 101,950 H.P. of plant, and three stations under construction, which will contain 34,600 H.P., or 136,550 H.P. in all, including spares. As this group of undertakings, though still progressing fast, has obviously arrived at a much fuller state of development than any of the other similar undertakings in the United Kingdom, it may be worth while noting the lines on which this is taking place. It is on the basis of having one uniform and interconnected distributing system extending over the whole area, fed by one main generating station working in conjunction with a number of subsidiary stations (ten, so far) all feeding in parallel into the interconnected network, the subsidiary stations being chiefly located where they can take advantage of waste products, such as exhaust steam or gas.

If we examine the areas of some of the other power companies, it will be found that the possibilities are as

great as on the North-East Coast, though, for reasons which are well known, it has been much more difficult to make a start, and future development on anything like the same scale will be more dependent on coming to a satisfactory understanding with, at any rate, some of the local authorities in the respective areas.

Parliamentary Committees have again and again lately, after exhaustive inquiries, emphasised the importance in their view of securing a comprehensive and uniform system of power supply over the metropolitan area, by whatever means this may be accomplished. Now, the metropolitan area which has been under consideration is much about the same in extent as several of the leading industrial areas in the provinces, and if the arguments are gone into, it is believed that they will be found to tell even more in favour of a uniform system of distribution over the provincial industrial areas than over the metropolitan area.

Experience has already demonstrated the amount of labour and the heavy financial strain which are involved in starting a comprehensive system of power supply over a considerable area. If, therefore, it is to the advantage of the country that such systems should be established, it is incumbent on those concerned that these undertakings should be treated with consideration and encouragement, and that serious efforts should be made to find an amicable *modus vivendi* which will permit of their being developed with fair rapidity and on sound engineering and commercial lines.

A PERIODIC FUNCTION.

By A. K.

I believe that, if statistics could be obtained, and if someone took the trouble, sine curves would be found to represent many things in our lives. Electrical engineers know of their occurrence in the technicalities of their own profession, but it will be my endeavour to show that sinusoidal properties attach to things which are not technical, not merely of academic interest, but which touch us very nearly, and in very sensitive spots.

We have all seen how trade rises and falls, and how, when trade is good, the price of coal, from having been low, grows high. The rise in the price of coal reacts upon the good state of trade generally, and production becomes more costly, so that prosperity becomes less. When this happens, there is a smaller demand for coal, and the price falls, and when it has fallen sufficiently low, it again becomes profitable to engage in trade.

Unemployment is greatest when prosperity is least, and follows the fluctuations of trade at a certain distance behind it. I think, in fact, coal prices and general unemployment are about two right angles behind general prosperity. Unemployment in the coal trade does not usually coincide with bad conditions in other trades. Trade disputes introduce harmonics into the curve, and modify its shape. We should find that the climb towards prosperity was gradual, and the departure from prosperity was quick, with a rapid descent towards worse conditions. There might be several points on the curve where discontinuity would be apparent.

However, without too much particularity, there is sufficient evidence that trade in general has periodic changes. Tides, the seasons, the phases of the moon, all these are periodic changes within everyone's knowledge.

The state of electrical engineering is at present one of low and depressed vitality. This is evident from the articles, letters and speeches of many men who are competent to judge, and it is now almost a platitude to remark that the conditions of business in the electrical trade are rotten. In the central-station branch of it, we are able to see, to some extent, how this is. Salaries are wretchedly low, and do not yet show any tendency to become better. Many towns which, in former years, paid salaries of £1,000 per annum and over to their chief electrical engineers, now pay six to eight hundred pounds, and increases are fewer and farther between.

Is this because the undertakings are less prosperous? The answer to this is "Yes and no." "No," in most cases they are doing better business than ever before, and doing more of it. Output and income have increased, and the surplus in the bank is growing, slowly, it is true, but still it is growing. "Yes," for we have grown up out of the infancy to which more or less facetious reference is still frequently made. We are now men, and are more serious-minded. We know what to look for, and how transient things are. We have come, in many cases, to a stage when every bit of business we obtain costs something to get; formerly there were people who were obliged to have electric light—would have had it at 8d. a unit—but these have all come, and new consumers have to be sought for diligently. So expenses go up, and we are liable to lose consumers to our friend the enemy—the gas man—at any time. It is surprising, in fact, what a little will send a consumer to gas, in some cases. With greater expense, and with more precarious income, we know that we are at a critical period in our lives.

Look at the advertisement columns of this paper, or any other electrical paper, week by week, and what do we see? Posts, for which a long and expensive training is required, advertised at miserably inadequate salaries. Then turn to the "Personal Notes," and it is found that for a £120-a-year job, there are a hundred and twenty applicants. There is a glut in the market of men, well qualified, desirous of getting on, but unable to move.

Ten or twelve years ago the electrical engineering department of a technical college was the most crowded of all its departments. Now it is the least crowded. Men employed in electrical work warn young fellows who ask their advice, to beware, or at least to be prepared for disappointment, if they take it up. There are signs that the influx of young college men is falling to some extent, and if this is true, it is bound to have its effect in time. If there are fewer applicants for positions, the positions will have to be made more attractive—that is to say, pay will become better. When pay becomes better, the rush to enter electrical engineering will again become noticeable, and a fall in wages will again take place.

Thus we see that fluctuations of a periodic nature take place in respect of our lives, as well as of certain incidents in our profession, and these touch us in that most sensitive of all sensitive spots, the pocket.

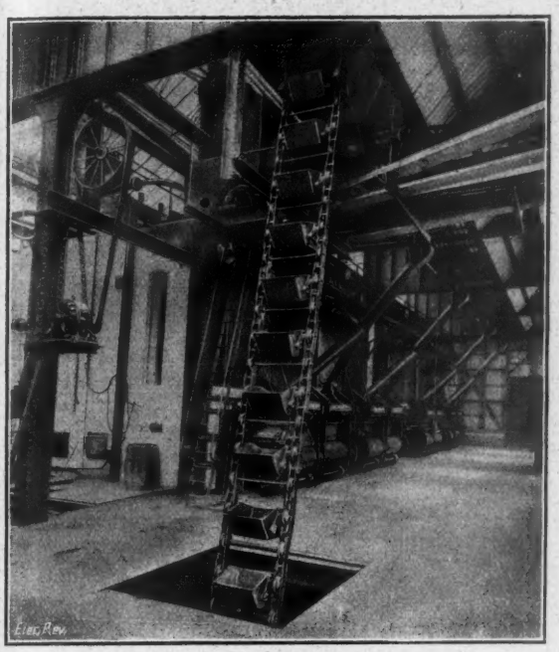
Although technical colleges are not putting into the world so many men as they formerly did, I venture to think that the correspondence schools, of which there are now so many, are not an unmixed blessing. So far as they help to improve workmen and assistants now engaged in electrical work, it is to be hoped they will prosper, for there is plenty of room for them in that direction. But the trouble is that every plumber and tinker will think that the well-known remarks, "I want to raise *your* pay," and others to the same effect, are really true. "Electrical engineering, the well-paid profession," incidentally babbles an advertisement in front of me as I write. One can almost see written in brackets after it, "Ironical cheers and laughter," and see the sneer with which the poor assistant looks at it on Friday morning as he turns hopelessly to the central pages, well knowing what he will find there—more of the same advertisements.

Oh! hollow! hollow! hollow!

Census of Production.—We have received from the Board of Trade a copy of the schedule issued to companies and local authorities interested in the generation of electricity, who are required to fill it up in accordance with the provisions of the Census of Production Act, 1906. Minute instructions are given as to the particulars required, and the mode of answering the questions. Besides the output and value of the work done, the cost of materials, number of employés and capacity of plant are scheduled. The questions are regarded in some quarters as unduly inquisitorial; the information given, however, will be treated as strictly confidential, and the national spirit of reserve ought not to be allowed to stand in the way of furnishing the necessary particulars. It is the unwritten law that everyone shall mind his own business; but everyone's business in a civilised community is bound up with that of everyone else, and one owes duties to the community which cannot be ignored. The results of the census will be anticipated with interest; it is the first of its kind, and will doubtless throw a light on many phases of British industry and trade that have hitherto remained in obscurity.

COAL-HANDLING AT COVENTRY.

The rapid extension of electricity supply in the Coventry area led recently to the decision to modernise the boiler-house plant at the electricity works, with a view to obtaining low fuel costs by the



The Boiler House, Coventry Electricity Works, Showing Bennis Conveyor and Stokers.

installation of up-to-date and efficient machinery, and the use of suitable coal.

In this connection the installation, which has recently been carried out by Messrs. Ed. Bennis & Co., Ltd., Little Hulton, Bolton, includes a complete coal and ash-handling plant with overhead coal and ash bunkers, and Ingrey weighing machine, together with eight of the new close-link Bennis patent improved smokeless chain grate stokers, fitted with Miller-Bennett chain.

A few of the more interesting details of this plant are as follows:—

The bunker capacity is 750 tons, and when the next half of the boiler house is erected, the capacity will be increased to 1,500 tons.

The overhead coal and ash bunkers are formed of rolled-steel joist framework securely braced together.

The conveying plant consists of:—Barge-unloading conveyor, a gathering conveyor, coal bucket conveyor, and ash conveyor.

The barge, loaded with coal, comes up to the bank of the canal, and lies alongside, and the unloading conveyor is then brought into operation. This conveyor is arranged in a culvert running parallel with the canal, and is situated in the best position to allow of an easy discharge of coal from the canal barge at the rate of 20 tons per hour. The conveyor is of the well-known Bennis type, and consists of a series of U-shaped links made out of 2 in. × ½ in. open-hearth acid mild steel flats. The chain works in a trough which is made of close hard-grained iron, the sides being provided with cast-iron plates, forming a continuous hopper, thus allowing the coal to be thrown in at any point in the length of the conveyor.

The links are 12 in. in pitch and secured at the joints by means of specially constructed rivets and washers. The return chain of the conveyor is carried on cast-iron rollers with chilled peripheries running in solid, grease lubricated bearings which form part of cast-iron brackets bolted to the conveyor trough. The entire scheme provides for another barge-unloading conveyor.

The gathering conveyor is also arranged in a culvert and is at right-angles to the unloading conveyor described above. It is thus in a position to receive the fuel from the unloading conveyor and also from a temporary coal store, if necessary, and furthermore, it can discharge the fuel into a hopper arranged for feeding the gravity buckets. The gatherer is of the same type as the "Bennis U-link conveyor," previously described, but in this case the trough in which the chain runs is 15 in. wide × 8 in. deep. The conveyor works at double the speed of the unloading conveyor, and will handle fuel at the rate 40 tons per hour.

The coal conveyor is of the continuous gravity bucket type. The buckets are 18 in. × 20 in. × 9 to 12 in. in depth, giving a capacity of 2,160 cb. in. The chain forming the conveyor is made up of two strands connected by mild steel axles 1 in. in diameter coming between each bucket, and retains the gauge of the rollers to suit the track. The trunks of this kind of conveyor are substantially formed out of mild steel channels and plates braced together. The advantage of this particular style of construction is its great strength; it is, moreover, self-contained and is very simple in design, owing to the few parts used in its construction. The conveyor is fitted with all the necessary tumblers, tipping quadrants, tension devices and driving gear. The capacity of this conveyor is 40 tons per hour.

The ash conveyor is carried on a light steel truss, and transfers the ashes from the overhead storage banker into the canal barge or cart. The shoot and tension end of the conveyor are carried on a light steel framework. The conveyor itself is of the Bennis U-link type, the trough in which the chain works being 9 in. wide × 6 in. deep.

It may be stated that the coal is not touched by hand from the time it is thrown out of the barge till the ashes are drawn out of the ash pit.

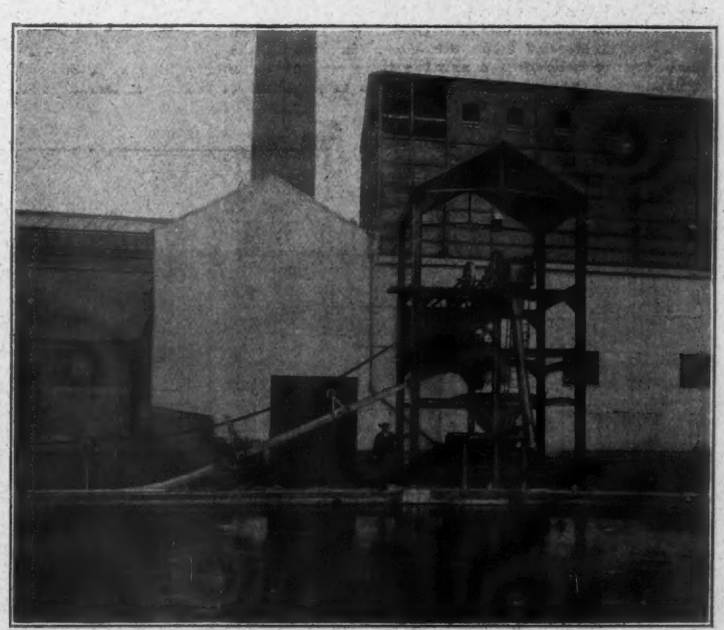
Easy access is obtained to the conveyors by means of suitable gangways protected by hand-rails.

The coal-weighing apparatus consists of an Ingrey weighing machine.

One of the most important features of the entire plant is the stoker installation. As we have already stated in mentioning the extent of the contract, eight Bennis patent chain grates are in position.

In considering the value of the new installation to the power-users of Coventry, and to the ratepayers who benefit by the profits of successful working, a strong point claimed for the scheme is economy in working. As bearing on this all-important subject, we may instance the fact that the amount of energy required to deliver one ton of coal into the overhead bunkers when the plant was absolutely new, and therefore took more power, was 1 unit, which would cost to manufacture something under ½d. Two tons of coal are therefore delivered from barge to boiler for 1d.

With regard to the driving of the plant, every conveyor has a motor of its own. The weight of the chain and buckets complete is over 14 tons, and 7 H.P. is required to work it. Motors employed in working the entire plant:—5 H.P. for stokers, 7 H.P. for gravity



Bennis Unloading Plant, Coventry.

bucket conveyor, 5 H.P. for ash conveyor, 5 H.P. for cross conveyor, 5 H.P. for gathering conveyor. It will thus be seen that the total amount of power necessary is less than 30 H.P.

Amble Electric Lighting.—The Electric Lighting Order of 1902 has been revoked.

A NORWEGIAN POWER-TRANSMISSION PLANT AT 50,000 VOLTS.

By DR. ALFRED GRADENWITZ.

The power house installed near Kykkelsrud, Norway, utilises the water-power of the Glommen, which is the biggest and richest in water of all Norwegian rivers, traversing the country in a southerly direction. The Kykkelsrud Falls, which have been utilised since 1903 for the generation of electrical energy, are situated in the lower part of its course, at about 63 km. to the south-east of Christiania. The installation comprises alternators generating current at a pressure of 5,000 volts, which is raised by transformers to 20,000 volts, and transmitted as far as 87 km. by several long-distance lines.

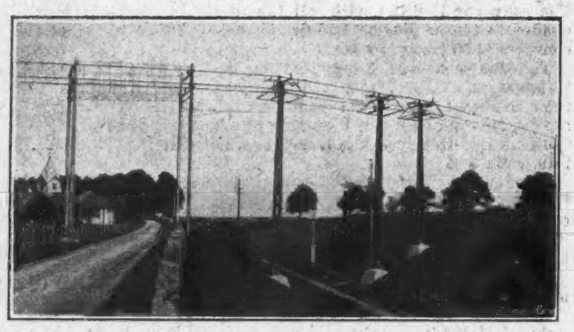


Fig. 1.—Line Crossing Road and Railway.

A hydro-electric power plant is situated at Hafslund, about 42 km. to the south of the former. This likewise utilises the water-power of the river Glommen, which at that place forms the Sarpsfos Waterfalls. The current there generated is three-phase current at 5,000 volts pressure, which is mainly used for chemical purposes.

Both of these installations have been recently extended by their constructors, the Siemens-Schuckert Works; and, in order to relieve Hafslund, it has been found advisable to provide for a mutual connection, so as to be able to transmit from Kykkelsrud to Hafslund an amount of up to 8,000 kw. This power-transmission plant is briefly described below.

The Kykkelsrud power house was extended by the addition of two three-phase generators of 3,750 h.p. each. In view of the considerable distance to be covered and the large amounts of energy to be handled, it was thought advisable to use, instead of the pressure of 20,000 volts as above mentioned, a higher pressure amounting to 50,000 volts. Owing to recent improvements in the design of electrical apparatus, the insulation of the transformers and conductors, as well as the installation of safeguards against excessive pressures, did not offer any insurmountable difficulties. By providing for this increase in pressure, which allows the current and cross-section of conductors to be reduced in proportion, the range of the electrical power transmission plant has been considerably increased.

Four transformers of 2,250 k.v.a. each are used to raise the pressure from 5,000 to 50,000 volts. The long-distance transmission line comprises three copper cables, each 64 sq. mm. in cross-section, and is arranged in an equilateral triangle of 1·4 metres side. The insulators are fixed by means of hemp and shellac on iron supports carried by iron brackets. Most of the poles carrying the conductors are wooden poles, iron poles having been installed only at angles or at railway or river crossings. The poles are installed at average distances of about 31 metres, and they are 12 metres in total length, of which 1·8 to 2 metres is embedded in the soil. When taking into account the deflection of the wire, the height of the lowermost conductors above the ground works out at 8 to 8½ metres.

Fig. 1 represents the poles used at road or railway crossings. In order to eliminate any danger resulting from the breakage of a wire, a protective net over the road has been provided, while a device fixed on the iron poles causes any broken wire to be grounded instantly.

While only one transmission line has so far been laid out, poles for another line, running at 10 metres' distance parallel to the former, have been provided.

A special station erected at Hafslund contains four transformers of 2,000 k.v.a. each (fig. 2). These transformers are immersed in oil, water-cooled by circulating pipes. They have been designed for a primary voltage of 45,000 volts (taking into account the losses due to transmission), while the secondary pressure amounts to 5,000 volts.

The transmission line arriving at the transformer station is provided with a water-jet earthing-device fitted below the point of entrance in the wall. Twelve 5,000-volt lines arriving from the Hafslund power-house enter on the other side of the building. These lines are connected to the secondary side of the transformers in the switching hall of the transformer station (fig. 3). The transformer lines enter from the left, and in the background are seen the points of issue of the twelve lines coming from Hafslund, while the very conveniently arranged switchboard for connecting the two systems in parallel is seen to the right.

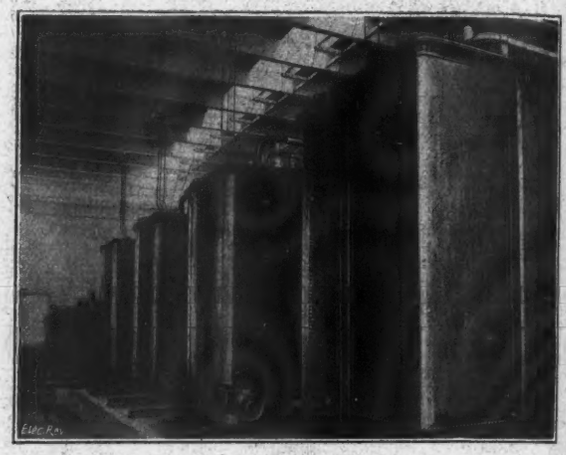


Fig. 2.—Hafslund Step-Down Transformers.

A water-jet earthing device on the 50,000-volt circuit, and a choking coil designed in stages with several horn spark-gaps and oil resistances inserted into the earth conductor of each of the three lines, are provided as safeguards against surges or atmospheric discharges. In addition, there is fitted to each of the three high-pressure bus-bars in the two stations a very long horn spark-gap.

This plant was inaugurated without any hitch in operation and has so far given every satisfaction, the 50,000-volt bus-bars at the secondary station having been readily connected through the transformers in parallel with the 5,000-volt bus-bars of the Hafslund power-house with a view to a common current supply.

Fig. 3.—Switch Room at Hafslund.

Chile.—We are informed that Messrs. Morrison & Co., of Valparaiso, and 5, Budge Row, London, E.C., have been appointed contractors for stores to the Chilian Navy for a period of five years. The contract covers a large field embracing engineering stores and supplies, electrical work, chemicals, drugs, surgical sundries, hardware, upholstery materials, and practically everything required by a modern navy.

Patent Application.—Application has been made by Henry Chitty for the restoration of patent No. 9,397, of 1902 ("Improvements in dynamo-electric machines"), which expired on April 23rd, 1908, owing to the non-payment of renewal fee.

BOARD OF TRADE REGULATIONS FOR OVERHEAD WIRES.

The following regulations have been issued by the Board of Trade, with special reference to overhead wires for low and medium-pressure continuous current, and low-pressure alternating current. ("Low pressure" is defined as up to 250 volts; "medium pressure" as 250 to 650 volts):—

General.

1. Nothing in these regulations shall be deemed to authorise the owner to break up or interfere with any street.

2. Where the pressure of the supply exceeds 250 volts, all wires, switches and metal work in connection with the supply shall be so enclosed or shall be fixed in such a manner that there shall be no risk of any shock being obtained by inadvertence or in the ordinary handling thereof.

3. Where the pressure of the supply exceeds 650 volts, the supply shall be subject to such further regulations as the Board of Trade may make, or shall be given on such conditions as they may prescribe.

4. The insulation of every electric circuit (whether connected with earth in accordance with these regulations or not), including all machinery and apparatus forming part of or in connection with that circuit, shall be so maintained that the leakage current shall not exceed one-thousandth part of the maximum current; and suitable means shall be provided for the indication and localisation of leakage. Every leakage shall be remedied without delay. Every such circuit shall be periodically tested for insulation.

5. In the use or delivery of energy, the owner shall exercise all due precautions so as to avoid the risk of causing electric shock or fire, and shall be responsible for all electric lines, fittings and apparatus belonging to him, or under his control, being maintained in a safe condition.

6. Any electric line or any support therefor exposed to liability to injury from lightning shall be efficiently protected against such liability.

7. All mains below ground shall be so laid and protected as to avoid risk of damage by accumulation of gas or leakage of electric current.

8. Where any accident by explosion or fire, or any other accident of such kind as to have caused or to be likely to have caused loss of life or personal injury has occurred at any part of any electric line or other works, the owner shall give immediate notice thereof to the Board of Trade.

9. Every reasonable means shall be employed in the placing and use of electric lines to prevent injurious affection, whether by induction or otherwise, to any electric lines or other works of the Postmaster-General or the telegraphic communication through any such lines.

10. (*a*) The owner on receipt of these regulations shall forthwith serve upon the Postmaster-General a notice describing every electric line used for the supply of energy, together with a plan showing the mode and position in which such electric line is laid.

(*b*) The Postmaster-General, upon consideration of such notice and plan, may require such alteration in the position and mode of laying, or mode of use of such electric line, or compliance with such other conditions as he may think necessary for the due protection of his electric lines or other works, and any failure on the part of the owner to comply with such requirements shall be deemed to be a non-compliance with these regulations.

(*c*) Any notice required to be served upon the Postmaster-General under these regulations may be served by being addressed to him, and left at, or transmitted through the post to the General Post Office, London, and any notice required to be served on the owner may be served by being addressed to him and left at, or transmitted through the post to, his office or last known place of address.

Overhead Lines for Low-Pressure and Medium-Pressure Continuous-Current Supply and for Low-Pressure Alternating-Current Supply.

11. All overhead lines shall be attached to insulators, and shall be so guarded that they cannot fall away from the support.

12. An overhead line shall not in any part thereof be at a less height from the ground than 22 ft., except with the consent of the Board of Trade, and shall not be accessible to any person without the use of a ladder or other mechanical means.

13. Where an overhead line crosses a street, the angle between the line and the direction of the street at the place of crossing shall, where practicable, be 60° at least, and the spans shall be as short as possible.

14. Where an overhead lines crosses, or is in proximity to, any wire or metal, precautions shall be taken by the owner against the possibility of the line coming into contact with the wire or metal, or of the wire or metal coming into contact with the line by breakage or otherwise.

15. Every support for an overhead line shall be of a durable material, and shall be properly stayed against forces due to wind pressure, change of direction of the line, or unequal lengths of span.

16. The interval between any two poles used singly as supports for an overhead line shall not exceed 200 ft. In the case of supports other than single wooden poles the intervals between the supports shall be such as may be prescribed by the Board of Trade.

17. The factor of safety shall be for overhead lines at least 5, and for wooden poles at least 10, and for iron or steel structures at least 6, taking the maximum possible wind pressure at 30 lb. per sq. ft. No addition need be made for possible accumulation of snow.

18. Service lines from overhead lines shall be led as directly as possible to insulators firmly attached to some portion of the consumer's premises which is not accessible to any person without the use of a ladder or other special appliance. Every portion of any service line which is outside a building, and is within 7ft. from the building, shall be efficiently protected by insulating material.

19. Every overhead line, including its supports and all the structural parts and electrical appliances and devices belonging to or connected with the line, shall be duly and efficiently supervised and maintained as regards both electrical and mechanical conditions.

20. Where a supply is given by overhead lines from a two-wire system, with the negative conductor connected with earth, the positive conductor shall be placed above the negative conductor in such a manner that in the event of breakage it must fall on the negative conductor.

21. Where a supply is given by overhead lines on the three-wire system, the positive and negative conductors shall be placed side by side above the intermediate conductor. The intermediate conductor shall consist of two wires placed side by side at a distance apart greater than that between the positive and negative conductors, and connected in each span by two cross wires, placed in such a manner that in the event of either the positive or negative conductor breaking it shall fall on one at least of the cross wires.

22. The owner shall remove any overhead line upon ceasing to use it for the supply of energy, unless upon so ceasing he satisfies the Board of Trade that he intends to bring it into use again within a reasonable time.

23. Overhead lines for pressures exceeding medium-pressure continuous current or low-pressure alternating current shall be subject to such further regulations as the Board of Trade may make or such conditions as they may prescribe.

Sub-stations and Transformers.

24. Sub-stations shall be established in suitable places and shall be in the sole occupation and charge of the owner and subject to any requirements of the Home Office. Where transformers are used in any other premises (not being sub-stations as defined for the purposes of these regulations) they shall be so guarded and protected as to avoid the risk of causing electric shock.

Compulsory Connection of a Three-Wire System with Earth.

25. Where the pressure of a supply between the adjacent conductors of a three-wire system exceeds 125 volts, the intermediate conductor shall be connected with earth, in accordance with the following conditions:—

(*a*) The connection with earth of the intermediate conductor shall be made at one point only on each distinct circuit—namely, at the generating station, sub-station, or transformer, and the insulation of the circuit shall be efficiently maintained at all other parts.

(*b*) The current from the intermediate conductor to earth shall be continuously recorded, and if it at any time exceed one-thousandth part of the maximum supply current, steps shall be immediately taken to improve the insulation of the system.

Optional connection of other Circuits with Earth.

26. The owner may, with the approval of the Board of Trade given with the concurrence of the Postmaster-General (but not otherwise), connect any other circuit with earth, provided the following conditions are complied with, namely:—

I.—General.

1. The connection with earth shall be made only where energy is delivered to each circuit, that is to say, at a generating station, sub-station or transformer, and shall be made at a neutral point in the circuit and in such a manner as will ensure at all times an immediate and safe discharge of energy.

2. The connection with earth shall be efficiently maintained, except when it is interrupted by means of a switch or link for the purpose of periodical tests for ascertaining whether any current is passing by means of the connection to earth.

3. The insulation of the mains shall be efficiently maintained at all other parts.

4. Tests shall be periodically made to ascertain whether any current is passing by means of the connection to earth, and if at any time the current so passing exceeds one-thousandth part of the maximum supply current of the circuit, steps shall be immediately taken to improve the insulation.

II.—Special.

(A). Separate or three or four-core mains used for alternating current where a low-pressure supply is given between a phase and the neutral point, or where the pressure between any two conductors exceeds 250 volts.

The connection with earth shall be made in the case of:—

(*a*) A single-phase supply, at the neutral point on the winding of the transformer.

(*b*) A two-phase three-wire supply, by means of the third wire.

(*c*) A two-phase four-wire supply, at the neutral point on the winding.

(*d*) A three-phase three-wire or four-wire supply, at the neutral point on the star winding.

(B). Concentric mains used either for continuous or for alternating current.

The connection with earth shall be made by means of the external conductor.

The Regulations, as will be seen, do not differ materially from those formerly in force (until May, 1905); they are mainly identical with, or closely similar to, Regulations existing in the various codes previously issued, and now brought together in connection with overhead wires.

NEW PATENTS APPLIED FOR, 1908.

Compiled expressly for this journal by W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

20,930. "Improvements in electric lamp-holders." W. Fennell and W. P. Perry. October 5th.

20,933. "Improvements in and relating to alternating-current motors of the commutator type." British Thomson-Houston Co., Ltd. (General Electric Co., U.S.) (Date applied for under Rule 13, March 28th, 1908. An invention comprised in Application No. 6,959, dated March 28th, 1908.) October 5th. (Complete.)

20,937. "Improved feeding mechanism for arc lamps." C. E. G. Gilbert October 5th.

20,964. "Improvements in accumulators or secondary batteries." C. R. O'Brien. October 5th.

20,968. "Improvements in telephone systems." D. Sinclair and W. Aitken. October 5th.

20,969. "Improvements in or relating to the control of electric motors." J. G. V. Lang. October 5th. (Complete.)

20,976. "Improved device for driving electric clocks and similar apparatus." W. Fairweather. (Aktiebolaget L. M. Ericsson and Co., Sweden.) October 5th. (Complete.)

20,988. "Improvements in adjustable electrically-driven non-portable driving apparatus applicable to grinding, sawing, milling, boring, drilling and the like." G. Robson. October 5th.

21,004. "Improvements in electrodes for accumulators." H. J. Haddan. (Nya Accumulator Aktiebolaget Jungner, Sweden.) October 5th. (Complete.)

21,021. "Improvements in and relating to electrical power transmission system." R. J. Houghton, P. Allman and W. T. Gray. October 6th.

21,075. "Improvements in switching apparatus for interconnecting the lines of a telephone exchange system." J. E. Kingsbury. (The Western Electric Co., United States.) (Date applied for under Rule 13, January 3rd, 1908. An invention comprised in application No. 197, dated January 3rd, 1908.) October 6th.

21,084. "Improvements in or relating to points or switches for railways and tramways." H. C. Houghton and W. Whitley. October 6th.

21,089. "Improvements in switches." W. M. Mordey. October 6th.

21,152. "Improvements in and relating to the electrical propulsion of ships." Siemens Bros. Dynamo Works, Ltd., and C. A. B. D. Koettgen. October 7th. (Complete.)

21,163. "Improvements in and relating to the regulation of dynamo-electric induction machinery." A. L. J. Schierbius. October 7th. (Complete.)

21,195. "Improvements in rotary current breakers." W. Ruthardt and H. Ruthardt, trading as Ruthardt & Co. (Date applied for under Sec. 91 of the Act, October 10th, 1907, being date of application in Germany.) October 7th. (Complete.)

21,202. "Improvements in and relating to safety appliances for electric trams, motor-cars and the like." W. E. Perry. October 7th.

21,208. "Improvements relating to electric conductors or cables." W. E. Hitch. October 8th.

21,213. "Improvements in electricity distributing boards or boxes." E. C. Lea. October 8th.

21,243. "Method of and apparatus for electro-plating." G. A. Lutz. October 8th. (Complete.)

21,263. "Improvements in the electric transmission of energy." R. A. Fessenden. (Date applied for under Sec. 91 of the Act, October 31st, 1907, being date of application in United States.) October 8th. (Complete.)

21,311. "Improvements in electric cranes." J. Marshall, J. Fleming and R. S. Anderson. October 9th.

21,332. "Improvements in holders for incandescent electric lamps." C. M. Dorman, R. A. Smith and H. G. Baggs. October 9th. (Complete.)

21,366. "Improvements in electricity rectifiers." T. J. Murphy. October 9th. (Complete.)

21,385. "Improvement in vacuous electric incandescence lamps having metallic filaments." Siemens & Halske Actien-Gesellschaft. (Date applied for under Sec. 91 of the Act, November 2nd, 1907, being date of application in Germany.) October 9th. (Complete.)

21,391. "Improvements in or relating to means or apparatus for detecting and magnifying the effect of electrical and other vibrations, pulsations and manifestations." A. G. Hellyar. October 9th.

21,393. "Improved device chiefly designed for use as an electric switch, but also applicable for producing motion for various purposes." W. H. Smith. October 9th.

21,396. "Improved drying chamber for electric cables." E. C. R. Marks. (Dr. Cassirer & Co., Germany.) October 9th. (Complete.)

21,398. "Improvements in apparatus for electrically-operating or controlling railway or tramway points." C. H. W. Edmonds and McKenzie and Holland, Ltd. October 10th.

21,402. "Combined insulated handle and cord grip for electric hand lamps or other electrical purposes." G. H. Ide. October 10th.

21,405. "Improvements in telephone instruments." W. Aitken. October 10th.

21,482. "Electrically-governed automatically operable train controlling systems." H. B. Miller. (Date applied for under Sec. 91 of the Act, October 10th, 1907, being date of application in United States.) October 10th. (Complete.)

21,490. "Improvements in and applicable to electrically-driven rail-less trains." F. Wagner. (Application for Patent of Addition to No. 4,637, 1908.) October 10th. (Complete.)

21,493. "Improved resistance for electrical heating and cooking apparatus and other purposes." G. Cooper. (F. Boelling, Germany.) October 10th. Complete.)

21,494. "Improved form of electrical cooking vessel." G. Cooper. (F. Boelling, Germany.) October 10th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1907.

Apparatus for Magnetic Separation of Ore. Metallurgiska Patent Aktiebolaget. 16,780. July 22nd. (Date applied for under International Convention, July 28th, 1906.)

System of Multiplex Telegraphy. S. Eisenstein. 21,106. September 23rd.

Apparatus for Measuring Electrical Resistance. Evershed & Vignoles, Ltd., and S. Evershed. 21,271. September 25th.

Armature Windings. Siemens Bros. Dynamo Works, Ltd., C. Altmann and W. Lau. 21,460. September 27th.

Electric Controllers for Railway Service and the like. T. von Zweigbergk. 21,588. September 28th.

Means for Supporting Electric Lamps. H. Hirst and G. Maurice. 22,700. October 15th.

Reversible and Collapsible Trolley Pole for Electric Vehicles. J. Lindsay and R. Lindsay. 23,780. October 28th.

Means for Controlling Brake Power on Electrical Tramway and Railway Vehicles. M. Cummins. 23,816. October 29th.

Means for Attachment to the Trolley Boom of an Electric Tram for the Purpose of Guiding the Trolley Wheel to the Live Overhead Wire. A. S. Chapman. 23,857. October 29th. (Post-dated April 29th, 1908.)

Electric Arc Lamps. P. M. Capitaine. 25,855. November 15th.

Apparatus for Controlling and Operating the Points and Signals of Electric Railways and Tramways. H. L. Turner. 25,630. November 19th.

Gas and Electric Lighting for Spinning Frames and the like. H. M. Girdwood. 27,850. December 11th.

Electric Resistances. W. F. Jones. 27,681. December 16th.

Alternating-Current Electric Motors of the Induction Type. British Thomson-Houston Co. (General Electric Co., United States.) 28,137. December 20th.

1908.

Photophonic Means for Use in Telephonic Transmission and Production of Photographic Records Applicable to such Transmission. J. F. Child. 4,391. February 26th.

Telephonic Transmitters or Relays. R. A. Fessenden. 7,493. April 4th. (Date applied for under International Convention, April 5th, 1907.)

Fixing Commutators for Dynamo-Electric Machines to their Supports. Siemens Bros. Dynamo Works, Ltd., and E. O. Kiefer. 8,133. April 18th.

Electro-Magnetic Sound Recording Apparatus. C. L. Chisholm. 9,800. May 5th.

Combined Electric Connecting Plugs, Sockets and Switches. W. W. Buckton. 10,184. May 11th.

Apparatus for Transmitting Telegraphic Signals. W. Hamilton. 11,099. May 22nd.

Electric Heating Apparatus. M. Hankin. 11,128. May 22nd. (Date applied for under International Convention, May 22nd, 1907.)

Telegraphy. I. Kitsee. 13,780. June 29th.

Appliances for Use with Telephone Transmitters for Preventing the Overhearing of Telephone Conversations. E. F. Hutton. 16,028. July 28th.

Electric Insulating Casing or Shield for Use by Linemen. G. E. Harrison and G. Burns. 16,136. July 29th. (Date applied for under International Convention, August 1st, 1907.)

Electric Motors. H. A. Mavor and Mavor & Coulson, Ltd. 57. January 1st.

Fixing of Telegraph, Telephone or other Electric Wires to Insulators. J. Munro. 955. January 15th.

Process for Making Electrolytic Depositions of Chromium. F. Salzer. 1,344. January 20th. (Date applied for under International Convention, January 21st, 1907.)

Treatment of Wood for Use in Electric Batteries and Electrolytic Cells. Chloride Electrical Storage Co. and B. Heap. 1,420. January 21st.

Electric Ignition Apparatus for Internal-Combustion Engines. Electric Ignition Co. and F. H. Hall. 1,964. January 28th.

Electrically-Driven Elevating Gear for Ordnance. Fried. Krupp Akt.-Ges. 2,490. February 4th. (Date applied for under International Convention, May 16th, 1907.)

Electrically-Driven Elevating Gear for Barrel Recoil Ordnance. Fried. Krupp Akt.-Ges. 3,684. February 18th. (Date applied for under International Convention, May 16th, 1907.)

Electro-Mechanical Transmission Systems for Automobiles and the like. H. Pieper. 5,160. March 7th.

Electric Switches. G. H. Sykes. 6,149. March 19th.

Electric Sliding or other Contacts. V. Lowendahl. 6,412. March 23rd.

High-Tension Magneto Ignition Apparatus for Internal-Combustion Engines. Chambers Motors, Ltd., and A. M. Patton. 7,747. April 7th.

Electric Locomotives. E. C. Ketchum. 7,750. April 7th.

Electric Switches. Thames Iron Works, Shipbuilding and Engineering Co. and W. H. Flood. 9,697. May 4th.

Apparatus for Preventing Collision between Ships by means of Electric Waves. G. Erdmann. 10,156. May 11th.

Construction of Telephone Jacks. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges., Germany.) 10,172. May 11th.

Electric Fuses fitted with Indicating Arrangements. Siemens Bros. Dynamo Works, Ltd. (Siemens Schuckertwerke Ges., Germany.) 12,050. June 3rd.

Repulsion Electric Motors. Siemens Schuckertwerke Ges. 13,451. June 24th. (Date applied for under International Convention, August 24th, 1907.)

Self-Locking Catch Pocket for Receiving Ownership-Denoting Tallies or Tokens arranged for an Electrical Release. G. H. Denison. 14,124. July 3rd.

Electric Water-Heaters. O. H. Fiddes and H. A. Seifke. 16,496. August 5th. (Date applied for under International Convention, December 18th, 1907.)

Magneto-Electric Machines. M. B. Tayoux, L. Chauchy and T. Fraysse. 16,900. August 11th. (Date applied for under International Convention, August 18th, 1907.)

Fixing and Supporting Overhead Electric Traction Conductors in Tunnels and the like. Siemens Bros. Dynamo Works, Ltd. (Siemens Schuckertwerke Ges., Germany.) 18,222. August 31st.